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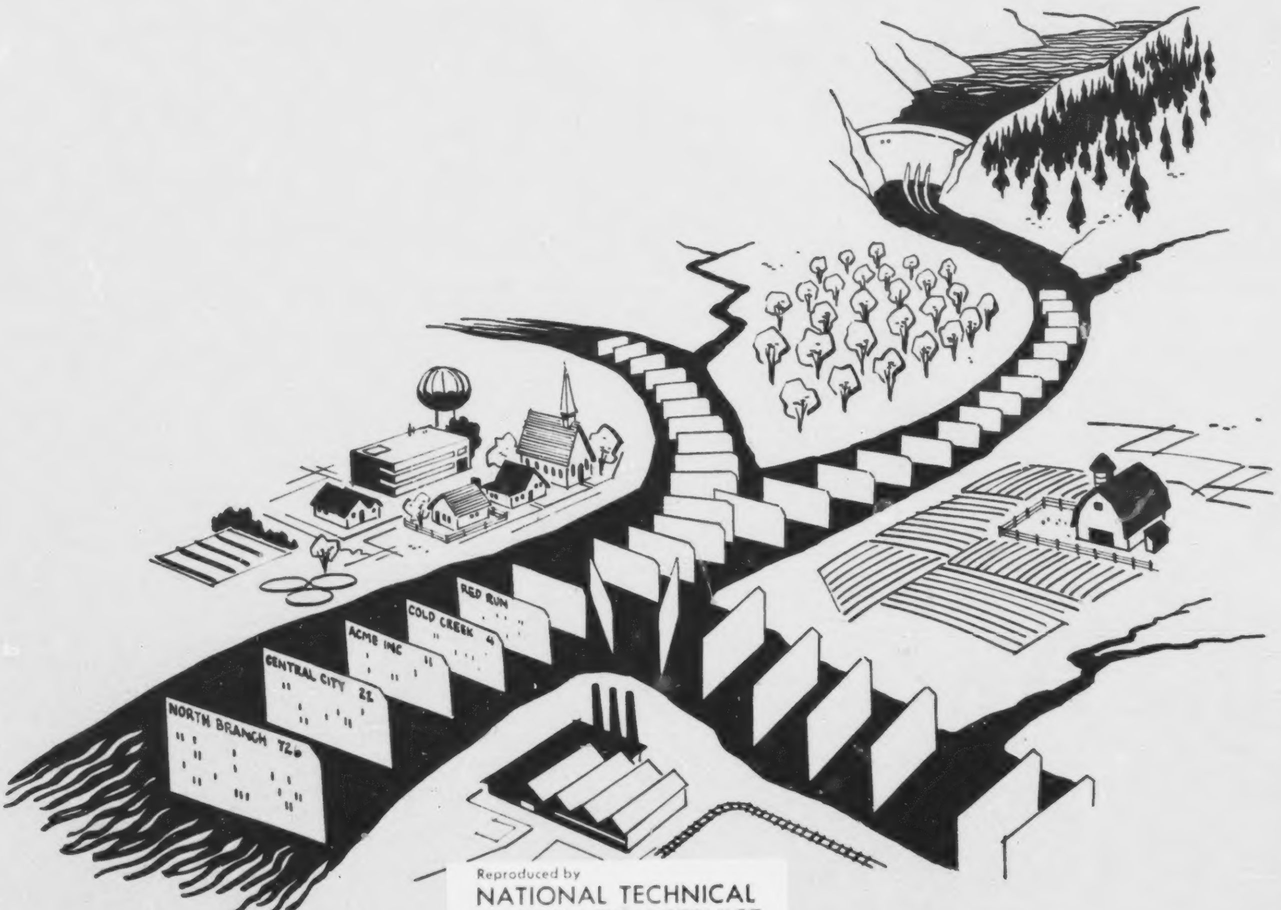
The River Basin Model:

DIRECTOR'S GUIDE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16. Abstract

The RIVER BASIN MODEL is a man-machine simulation model used to delineate the interactions taking place, within a real or hypothetical area, between the local water system and the economic, social, and governmental activities of that area; it is a model of an entire regional system, with water a subsystem realistically interacting with all the other major subsystems, such as transportation. The Director is responsible for the operation of the Model in a gaming mode; he acts as a communication link among all participants and frequently between participants (players) and the computer. He may make inputs and distribute output in various ways. Presented is a manual describing what the Director needs to know in order to operate the Model, influence play, answer questions and use the Model to meet established objectives. The guide focuses on three major areas: (1) Pregame--responsibilities before the start of a program, such as choice of structure and formation of teams; (2) Optional formats--provision for complementary activities, such as town meetings and mass media presentations; and (3) Model operations--details for operating the Model itself. (Bell-Cornell)

(~~See above~~ [illegible])

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Director's Guide

by

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1. INTRODUCTION

The Director is the person responsible for the operation of the model in a gaming mode. He could be regarded as the "controller" of the game or as the "coordinator", in the sense of being a communication link among all participants and frequently between participants (players) and the computer. The Director can influence the play throughout its duration by making inputs, acting as the Outside System, and distributing the computer output in various ways. The Director can also affect the play by how he forms teams and by the responsibilities he assigns to groups of players or to individuals.

The Director may be as active or passive as he desires. Operating the model does not require the Director to influence the play or make inputs, but the model does allow him to control play if he wishes to.

This manual (guide) describes what the Director needs to know in order to operate the model, influence play, answer questions and use the model to meet established objectives. This guide assumes the the Director is thoroughly familiar with the complete Player's manual.

This guide focuses on three major areas:

Pregame: Responsibilities of the Director before the start of a program including the choice of structure and objectives, selecting starting configuration, formation of teams, pregame instruction and motivation.

Optional Formats: Description of enrichment activities including complementary materials and exercises such as town meetings, public hearings, mass media, legal system, special projects and readings.

Operating the Model: Explanation of Director's role in running the rounds, using the output, making and inputting decisions.

2. DIRECTOR FUNCTIONS

There is, during the operation of the model, a continuous relationship between the Director, the computer and the participants. These relationships will be described in various ways in the next 3 chapters. The emphasis in this chapter is on some of the administrative options and requirements related to creating the framework for the model operation.

2.1 Pregame

As the Director, or teacher, gains experience he will employ his own techniques in conducting varied programs with the model. The elements identified below are intended as guides for consideration:

2.1.1 **Facility:** The ideal situation is a gaming laboratory designed specifically for the display and communication of information and the interaction of people with each other, available information and the computer. Whatever situation prevails, the Director should try for a facility which accommodates the display of general output, maps and charts; provides for the access of participants to each other and on occasion for assembly as a total group; and provides for desk or table working space for using computer output. A facility with controlled access to video or closed current TV, and/or microphones and/or reproduction capabilities has the elements for an effective mass media activity. Considerable momentum usually develops in the gaming of the model. Depending on the Director's objectives, he can create and cultivate momentum by assembling all activities in one room or modify intensity of interaction through the use of separate strategy (or functional) rooms in which activities can operate separately from each other.

2.1.2 Computer Access: Ideally, the computer (or input devices) will be close to, or part of, the gaming activity and will be an available hands on tool. Most directors, however, will probably have to establish a working relationship with a computer center or data processing activity. This should be done with care sufficiently far in advance to insure precision in scheduling, input and delivery of each round of output.

2.1.3 Program Structure: The model is flexible as are the Director's optional uses of it. In many cases, however, the program participants may be relatively inexperienced in the use of operational simulations or may be interested in general program guidelines. It is possible to structure the use of the model to serve as a short orientation of 2 or 3 rounds; to provide 5 or 6 rounds (years) of decision or policy testing or to run for extended instructional periods such as a semester or a budget cycle. (In this respect, the model can be said to have an infinite scenario.) For illustration only, a 5 day, 5 round, 15 hour program with a critique is portrayed in figure 1.

2.1.4 General Administration: The administration of a game should be conducted as unobtrusively as possible in contributing to the care of operation, and the interaction among participants.

Among many administrative devices several are of particular value.

(a) Rosters of participants: As a means of fostering communication, these should include the name and role, or position, of each participant and be available to all participants.

(b) Role tags: In the early rounds individual role tags, like name plates, assist in the interaction process. In a situation in which time is a critical element, it is useful to make quick and easy contact with members of the various sectors.

(c) Coloring devices: One of the most effective ways for participants to understand their geographic, economic and social relationships in the model is to distinctively identify their own sectors or locations and their relationships with other activities. Coloring the economic status map in rounds 1 and 2 accomplishes this very quickly. In addition all the activities of the Government Sector can be portrayed distinctively for planning purposes, developments and public presentations. Colored pencils, tape, magic marker and transparent overlays are all useful devices.

2.1.5 Distribution of Material: There is a considerable amount of written material and information for each model participant. It is useful, in some circumstances, to make this material available to participants prior to the beginning of the model program.

The distribution of material should be accompanied by some explanation and discussion of the information and its uses.

Figure 1

SCHEDULE

RIVER BASIN MODEL WORKSHOP OF

No. of Participants __________

Dates ____________________

Day 1

STAFF: ____________________

____

TIME	EVENTS		NOTES
9:00	Arrival of Participants at workshop		Location to be specified. Registration
9:15	A. Orientation		
	1. Brief introduction to gaming/simulation 2. Participants familiarization with gaming laboratory 3. Slide presentation - elements of the model 4. Selection of economic, social and governmental roles 5. Distribution of Round 1 Output	A3	This presentation includes an overall view of the components of the model, as well as an introduction to the role of the computer and the technical aspects of formats, inputs, outputs, etc.
	6. Individualized instruction; review of computer output, concepts, terms, numerical perimeters in each sector, etc.	A6	Individual instruction will provide the depth and detail in those areas introduced in A3.
	Brief analysis of the scenario. General guidance in the use of the manual and gaining access to information available in the whole model.		
10:30	B. Play of the Model 1. Participants begin Round 1	B2	Round 1 will be an instructive round in which participants will choose decisions from a variety of options available to them. The selection of these options by the participants will begin the actual process of decision-making, under pressures of time and information constraints, which will exist during the workshop.
12:00	2. Round 1 decisions submitted to computer		
12:15	Adjourn Session		
PM	. Afternoon or evening discussions among participants and with the staff are optional. . Before the second day, individual participants should become familiar with the model and generally acquainted with the activities of the various sectors. . All participants, particularly those interested in political office or political action, should "prepare" for the events of Day 2.	A,B	Questions are encouraged and solicited.

Figure 1 (Cont.)

DAY 2

TIME	EVENTS		NOTES
9:00	Arrival of Participants at workshop	B3	This output will reflect all decisions made in Round 1.
9:45	3. Distribution and review of Round 2 output 4. Town Meeting a. Review of status, decision-maker presentations b. Presentations by candidates for Chairman c. Submission of referendum votes and petitions d. Social sector caucuses; development of support for candidates and policies e. Election and referendum voting f. Development of goals and objectives	B4	This provides a forum for developing community interests and alternative strategies for running the city. A "Master Plan" proposal could be considered at this time, for instance. This first "public forum" is designed to acquaint all participants with the information in the whole model and the patterns, directions and special interests which are developing. Decision-makers should attempt to identify and isolate problem areas which they would like to have resolved.
12:00	5. Round 2 decisions submitted to computer		
12:15	Adjourn Session		
PM	The development of goals and objectives, and the subsequent "negotiation" of these among citizens, community and government, is a vital part of the workshop. This can be the creation and testing of a sense of community with the distinctive characteristics desired by the participants. The Director may introduce specific problems or plans or arrange for additional roles or activities associated with environmental issues or controls.	B4	d. The social sector should take advantage of their position through direct, closed session questioning of individual candidates.

Figure 1 (Cont.)

DAY 3

TIME	EVENTS	NOTES
9:00	Arrival of Participants at workshop	
9:15	7. Distribution and review of Round 3 output 8. Participants begin Round 3	B7-9 Special attention should be paid during this round -- and succeeding ones -- towards the implementation of goals and objectives previously developed and the introduction of "real" problems into the workshop.
12:00	9. Round 3 decisions submitted to computer	
12:15	Adjourn Session	
PM	It is desirable that the maximum amount of interaction among decision-makers occur during the workshop. This can take place through the initiating of participants in searching out information; performing their own critical analyses; critically examing policies, plans and programs; questioning public officials; forming citizens groups and making use of mass media potential. Strategies are needed for next rounds.	. In this round participants will be more fully aware of the variety of individual interests at work in the model, and can usually increase their interactions and their combined efforts. . Some exchange of'roles is possible at this time depending on participant interests.

Figure 1 (Cont.)

DAY 4

TIME	EVENTS	NOTES
9:00	Arrival of Participants at workshop 10. Distribution of Round 4 output and Master Plan Elements. 11. Participants begin Round 4 12. Round 4 decisions submitted to computer 13. Public Hearing a. Evaluation of attempts to implement goals and objectives b. Development of alternative strategies, programs, and policies	B 13 This public hearing will be primarily a government staff presentation indicating plans policies, problems and prospects. Public discussion inquiry and dialogue are expected. At this time, participants may switch roles and/or combine "teams" for the final round.
12:15	Adjourn Session	
PM	OPTIONAL . Discussion with staff or Director concerning changed roles or other aspects of the model. Visit to community or municipal function or neighborhood or school activity for observation or discussion related to workshop activity.	

Figure 1 (Cont.)

DAY 5

TIME	EVENTS	NOTES
9:00	Arrival of Participants at Workshop	
9:15	14. Distribution of Round 5 output 15. Participants begin Round 5	C1-3 The critique is an integral and valuable part of the gaming/simulation process. Comments are solicited from all participants. Discussion is open. Dialogue can relate to experiences or to the nature and uses of gaming/simulation. Particular interest should relate to the problems of region complexity.
10:45	16. Round 5 decisions submitted to computer	
11:00	C. Debriefing and Critique 1. Comparative analysis of play 2. Summary of actions, programs, results 3. Discussion of practical applications of the model in municipal or educational activities	
12:00	D. Awarding of Workshop Certificates Summary of objectives	Participants can explain their objectives and achievements.
PM	Distribution of Round 6 output	

2.2 Starting Configurations

The Director has the option of using one of two basic starting configurations that have already been loaded and are ready for use. Of course, the Director could develop completely different starting configurations of his own, or he could make changes in the two "canned" starting configurations by making inputs to the round 0 data base.

Figure 2 shows a few statistics for the local systems of the two basic starting configurations: TWO CITY and RAYWID CITY. The starting configuration called TWO CITY is a completely hypothetical regional area, while RAYWID CITY is fashioned after the actual Cleveland-Akron regional area (which contains the Cuyahoga River Basin).

Note that the population sizes are quite different with RAYWID having about nine times the number of people. RAYWID CITY also has a higher concentration of low income residents, a worse quality of life index, a lower average education level, a higher unemployment rate, and more overcrowded housing. In RAYWID CITY a larger percentage of the school population is enrolled in public schools and the student teacher ratio is slightly better than that for TWO CITY. The river system is more extensive in RAYWID and there are many more polluters in each of the categories of polluters.

Another set of considerations from the director's point-of-view when selecting which starting configuration to use, are the operational differences among different starting configurations, i.e. the number of teams and the running time on the computer. Figure 3 shows some operational characteristics for TWO CITY and RAYWID CITY.

Note that there is provision for many more teams in RAYWID CITY. Of course, the Director may give the control of the assets of several teams to a single individual or group of individuals, and there is no requirement that the number of players be as large as the number of starting configuration teams.

Figure 2

LOCAL SYSTEM COMPARISONS OF TWO CITY AND RAYWID CITY

	TWO CITY	RAYWID CITY
Land Area (square miles)	3906	2519
Parcels	625	403
Number of Political Jurisdictions	2	3
Total Population	275,500	2,508,000
Percent Distribution by Class		
HIGH	37	31
MIDDLE	36	34
LOW	27	35
Percent of Workers Earning Under $5000	33	36
Total Assessed Value (millions)	$12,733	$26,296
Average Quality of Life Index	69	117
Average Education Level	59	49
Unemployment Rate	7.5%	13.7%
Workers Receiving Unemployment	12,800	127,240
Student-Teacher Ratio	7	6
Percent of Students Enrolled in Private School	30	13
Housing Vacancy Rate	4	-1
Features of the Water Component		
Miles of River	87.5	130
Number of Rivers	3	7
Types of Polluters		
Surface Water Industries	4	14
Municipal Outflow Points	2	11
Farms Contributing to Runoff	3	8
Total Population (thousands)	276	2,508

Figure 3

OPERATIONAL COMPARISONS OF TWO CITY AND RAYWID CITY

	TWO CITY	RAYWID CITY
Number of Economic Teams	7	23
Basic Industry Only Teams	2	4
Commercial Only Teams	0	3
Residences Only Teams	2	5
Mixed Teams	3	0
Miscellaneous Teams	0	12
Number of Social Teams	7	9
High Income Only Teams	2	3
Middle Income Only Teams	2	3
Low Income Only Teams	1	3
Mixed Teams	2	0
Number of Separate Government Jurisdictions	2	3
Number of Government Teams	14	21
Chairman	2	3
Assessment	2	3
Utility Department (Water Office)	2	3
Municipal Services	2	3
Planning and Zoning	2	3
Schools	2	3
Highways	2	3
Bus	0	0
Rapid Rail	0	0
Approximate Number of Pages of Computer Printout	290	350
CPU Running Time		
360/40	60	200
370/165	5	10

2.3 Formation of Teams

A list of economic, social and government teams and their major characteristics is given as part of the description of each starting configuration. (See 2.2) The Director may desire to modify the number of teams, have a group of participants play more than one team simultaneously, or change the composition of a team.

2.3.1 Altering the Number of Teams:

(a) Economic Sector: For example, let us assume that there are seven economic teams, but that the Director wants only four. The reduction in the number of teams may be accomplished by either allocating the seven economic sets of output among four groups of players (this is the least complicated method because no input need be made to the computer) or by dividing the assets of the last three teams among the other four teams (this requires a set of input cards that indicate the purchase at zero price of the latter three teams' assets by the former four teams).

Another example, let us assume that there are seven economic teams and the Director wants ten. This can only be accomplished if the starting configuration permits additional economic teams, each of which has no assets or liabilities. Through inputs on the Round 0 base the zero balance teams may be given only cash, or they may be given land and developments from each of the four original teams.

(b) Social Sector: An increase or decrease in the number of social teams can be accomplished simply by combining or separating the output that presently is available as in the first example of economic teams. Since social teams do not have any output that is comparable to the cost statement and land summary statement in the economic sector, social output can be combined or separated with greater freedom. The social output is already separated by class and jurisdiction, thereby providing a straightforward basis for further division among participants.

2.3.2. Making Teams Operate Across Sectors: The Director may also wish to have a group of participants play several sector roles at the same time. For example, he might give a three-person decision group the economic output for Team A, the social output for Team AA, and the government output for the School Department and ask the group to play all three sectors simultaneously.

An alternative would be to have decision groups act as both economic and social teams, with individuals elected and appointed to the government teams. This would not only give every player an identification with an economic base and social interest group, but also allow him to perform as an individual in the Government Sector.

2.3.3 Changing the Resources of a Team: The Director may wish to alter the resources of an economic or government team. The extent to which the Director may do this might be as little as changing the cash holdings or adding debts, or as extensive as changing all the economic holdings so that each economic team has only one type of development. In this latter change, one team could control all the heavy industry; another team all of the Business Goods (BG) and Business Services (BS); and another team all of the single family (RA) housing of a certain quality index or in a certain area of the city. Conversely, the Director could change all of the economic holdings to represent geographical interests rather than functional specialization.

2.4 Distributing General Output

The Director can be selective in how he distributes the general computer output. In order to introduce the participants gradually to the complexity of play, the Director might choose not to explain and post all of the general output. Such information as the employment detail and the commercial detail might be withheld until the players request such information or until such time as the Director feels that this output should be introduced.

Moreover, the Director may choose to permanently withhold some of the output and simply "sell" information from the output to players who pay the price designated by the Director. This payment can be deducted from the team by inputting a cash transfer to the outside. He could do this because the information provided by some of the general output is much more than is typically available in the real world. Thus, the team payments for information could represent special surveys and research studies.

In the exercise of these options, the Director may also introduce additional roles or functions such as the mass media, which could include private or public television; consultants; and offices of information.

2.5 Optional Game Formats and Suggestions

There are a number of areas for variability in the game format of the model. This section will serve as a further explanation of those formats. These role descriptions are guidelines intended as a framework within which the Director can focus specific issues and applications which may be relevant to a particular group or a particular use of the model.

2.5.1 Mass Media: This role performs a communication function presently absent in the formal structure of the model. In a game-room context the Mass Media would control and use blackboards, a closed current TV or, a public address system or podium or copying machines for leaflets. Responsibility for this role is analogous to that of a newspaper, radio station, or television station in the community. Depending on the size of the group playing, and the facility, it may be desirable to have competing newspapers and television stations that vie for credibility and support from the participants, while exerting influence through advertising, public notices, announcements, editorials and campaign speeches.

The Mass Media may be established in one of several ways. An open auction or closed bid, conducted by the Director, could award the Mass Media to the highest bidder. In this case, a bidder must have available cash to pay the auction bid price. Payment for the Mass Media would be accomplished by a cash transfer of funds from the successful bidder's account to the Outside System. Since social decision-makers may not individually have sufficient funds, they would have to propose imaginative arrangements to bring about a consortium of roles to manage the Mass Media. Another way to establish the Mass Media would be simply through designation by the game director. The Mass Media sets its on data. These charges would be accomplished by cash transfer decisions, except in the Social Sector where information might also be made available free or for a non-cash charge such as traded votes or community support.

2.5.4 Alternative Forms of Government: There are numerous variations on a chief executive/elected council that are available as a governmental form. The structure of the model easily accommodates an elected mayor with no council, an elected mayor with council, an appointed city manager with or without council, or finally a council alone. Obviously, group executive decision-making has its drawbacks, but the council option may provide useful lessons. When configuration of more than one jurisdiction is used, executive decision-making may be combined and coordinated, but departmental decisions remain bounded by jurisdictional lines.

This does not preclude an executive body similar to a Metropolitan Council of Governments with advisory and policy-making powers that affect member jurisdictions.

The chief executive (Chairman) can be elected for a term of variable length, while the terms of councilmen may either coincide or overlap. Overlapping terms insure some continuity in the executive process. This is useful in a gaming situation where players are initially unfamiliar with many roles.

Since the chief executive is elected by the population, he must run on a platform that appeals to a majority of voters. This platform can represent a wide spectrum of idealogy.

2.5.5 Legal System The model format can operate without a legal system, and does so on a default basis with the game director providing regulations as needed. However, over a number of rounds of play, it may be desirable to establish a formal set of regulation and laws (rules) by which the game players carry out their activities. Such a set of regulations may be termed the "Legal System". The legal system acts as the vehicle to enforce laws and regulations established by the council, and/or chairman through a judiciary and penal code.

A judge (or judges) may be either elected at large from the group of participants, or be appointed by the chairman or game director for a specified term (minimum of 3 rounds is suggested). A penal code can be drawn up during the first round (or pre-determined and ratified by the population units as a referendum). Thereafter, amendments may be drawn up and approved by the council and/or chairman.

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own charges for "air time" and "newspaper space". These charges to users would be accomplished by cash transfer decisions.

2.5.2 Federal-State Aid Controller This role performs a channeling and dispensing function for financial aid, presently handled in a probabilistic manner in the model. Responsibility in this role is analogous to that of a Federal or State Agency lending funds and granting assistance to municipalities on a shared or matched basis. Since most funding for the municipal departments is accomplished through the computer, this role could function as a "pork barrel" of federal funds to be distributed at the discretion of the F-S controller. These funds could be in addition to those requested via computer decisions. One basis upon which the departments would be eligible for funds could be through an application proposal to the F-S controller. Such applications, stating the need, objectives, and intended use of requested funds, could be reviewed by the F-S controller and funds could be allocated in accordance with a pre-determined goal or priority, or at the direction of the controller. This particular process may be of considerable training value for groups which are interested in real life applications for federal-state aid.

The F-S controller may be selected by the game director, elected by the social sector, or hired from a series of applicants by the municipalities. Funds are made available for this role via cash transfers from the Outside System. Annual funds should reflect the status of the National Business Cycle, (i.e., upswing or downswing); or the Director may replicate congressional appropriations with funding cut-offs in certain areas, (i.e., no money for education, only for crime prevention through MS department). The Director should specify an upper limit for the F-S controller each round.

2.5.3 Data and Information Consultant This role allows advice and information retrieval to be profitable for an economic decision-maker or government department who chooses to accept the responsibility. With control of the employment and shopping diagnostics, along with land values, and summary data, this role can acquire participants. Thus, this role is analogous to an economic or social survey consultant offering analytical information (at a price) to government and business interests.

The Data and Information Consultant may be established through a bid or auction procedure similar to that described for the Mass Media. Once designated, the D & I Consultant is able to charge his own rates for consultation

2.5.6 Insurgency: This activity, at the discretion of the Director, could be performed by any participant willing to accept the potential consequences of punishment via the penal code. For instance, a player may decide to "blow-up" an industry which he and others are striking against for higher wages. The effects of this action will be borne out in future rounds for everyone to observe: loss of potential jobs, reduction of tax base, loss of investment, surplus of labor, lowered wages elsewhere, additional welfare and reconstruction costs. "Blowing up" a development can be accomplished by submitting a demolish decision. The player(s) responsible for this decision must identify themselves to the judiciary and their subsequent escape or arrest could be determined on a random basis proportional to typical crime statistics. (i.e., rolling dice four times to obtain four 6's might mean escape, while failure to do so would subject the player(s) to the penal code.

The penal code might call for player "imprisonment" for 3 rounds with loss of 1/2 of his assets and all decision-making power. In the case of Social Sector players, there might be loss of voting rights, loss of jobs, and loss of decision-making ability. (Loss of jobs could be accomplished by submitting boycott decisions against primary employers in the system.)

2.5.7 Holding Corporations: This technique is fairly common in the business world, and allows several economic decision-makers to divide or combine assets for specific purposes. For instance, one economic decision-maker may "buy out" another and use the "bought" role as a finance company for making loans to other players; or perhaps all highrise housing may be combined, operated, and maintained under one "umbrella" corporation. Such a technique could demonstrate the effectiveness of "single purpose" corporations to the game players. Holding corporations can be set up by simply transferring assets and holdings to a vacant decision-making role.

2.5.8 Building Inspector or Housing Coordinator This role allows for a checking and inspection process of all developed facilities, especially dwelling units. Likewise all new construction might be reviewed and approved through the Building Inspector to insure that proposed projects meet minimum standards as expressed in value ratio, maintenance levels, conformance to master plan, and the meeting of established municipal policies, such as distribution of low income, low cost housing.

The Building Inspector could be appointed by the Director or Chairman, or a member of the Planning and

Zoning Department could serve as Building Inspector in an ex-officio capacity.

2.5.9 Citizen Commissions : There are several bodies of representative citizens that may be implemented to focus on specific functions.

(a) A Planning Commission, composed of citizen representatives elected from (pre-defined) wards, would serve a deliberative appeal and approval function, while the Planning and Zoning Department would serve as a staff function. Issues and policies would be directed from the Commission to be articulated in plan terms by the Department staff. The commission would be directly responsible to the population, while the department would be responsible to the commission, and to the Chairman. Ex-officio members could then be added at the discretion of the game director.

(b) A School Board, composed of citizen representatives elected from each of the School Districts, whose functions would be analogous to those of the Planning Commission, but focused on matters of educational policy.

(c) An Environmental Quality Control Commission can be established as an advisory or regulatory body with a variety of powers or influences related to the control and development of activities which influence the Environmental conditions.

(d) A Commission, composed of citizen representatives elected from a designated neighborhood area would be a deliberative and action group responsible for attaining and implementing special funds made available for their "Model Cities Neighborhood". These funds would be in addition to the normal municipal funding via government departments, and could be available from the Federal-State Aid Controller.

2.5.10 Citizen Interest Groups : Informally, participants may choose to organize the population units they represent in a number of ways to make their voices heard more effectively.

(a) Ad Hoc Committees to focus on specific issues such as school quality, overpricing, housing quality, or zoning practices could be made up of those decision-makers concerned enough about an issue to mobilize and act as a coalition.

(b) Pressure groups might consist of decision-makers or population units with common goals and interests such as land-owners, people on welfare, or purchasers of

Business Services. Such groups could develop a residual attitude and policy which would represent an identifiable force in the political process.

(c) Unions might consist of low and middle income population units working at a specific location, or perhaps a white collar union of high income workers at a National Services (NS) establishment. These organizations could articulate the goals and desires of their constituency and be composed of a representative hierarchy.

(d) Political parties could be formed by social decision-makers who would register their population units at the beginning of play based on a given philosophy for each party. Such a structure might encourage patronage in the Government departments along party lines and party idealogy.

2.5.11 Long Range Advance Planning It is frequently desirable to have a long range planning activity at work concurrently with the year to year actions of Planning and Zoning. This function can develop 10, 20 or 30 year projections for public review and possible acceptance. In some cases it may be desirable to establish an advisory group similar to a regional or metropolitan council of governments to develop the planning projections and explain their implications.

3. RELATIONSHIPS

As previously indicated the Director can have a focal role in the operation of the model.

The Director may select the starting configuration used by the participants, change a number of conditions before the start of play, and have a continual effect on the operation of the model through the use of the many director options.

Figure 4 portrays the Director's position in relation to the computer operations, the simulated area, and the participants. After having determined the overall objectives of using the model and assembling a group of participants, the Director selects one of the initial starting positions. Each of the starting positions has resources distributed among the sector teams and specified cash balances in the accounts of the economic and government teams. The Director may alter initial starting characteristics by making inputs to the computer before the participants begin play.

Referring again to Figure 4, the Director should check his use of the following five types of options:

1. Choice of starting configuration. Presently he may choose TWO CITY or RAYWID CITY without having to deal with loading a new configuration.

2. Making round 0 decisions to alter the basic starting configuration selected. This might be done to change team assets, create local system problems, or reduce the number of teams.

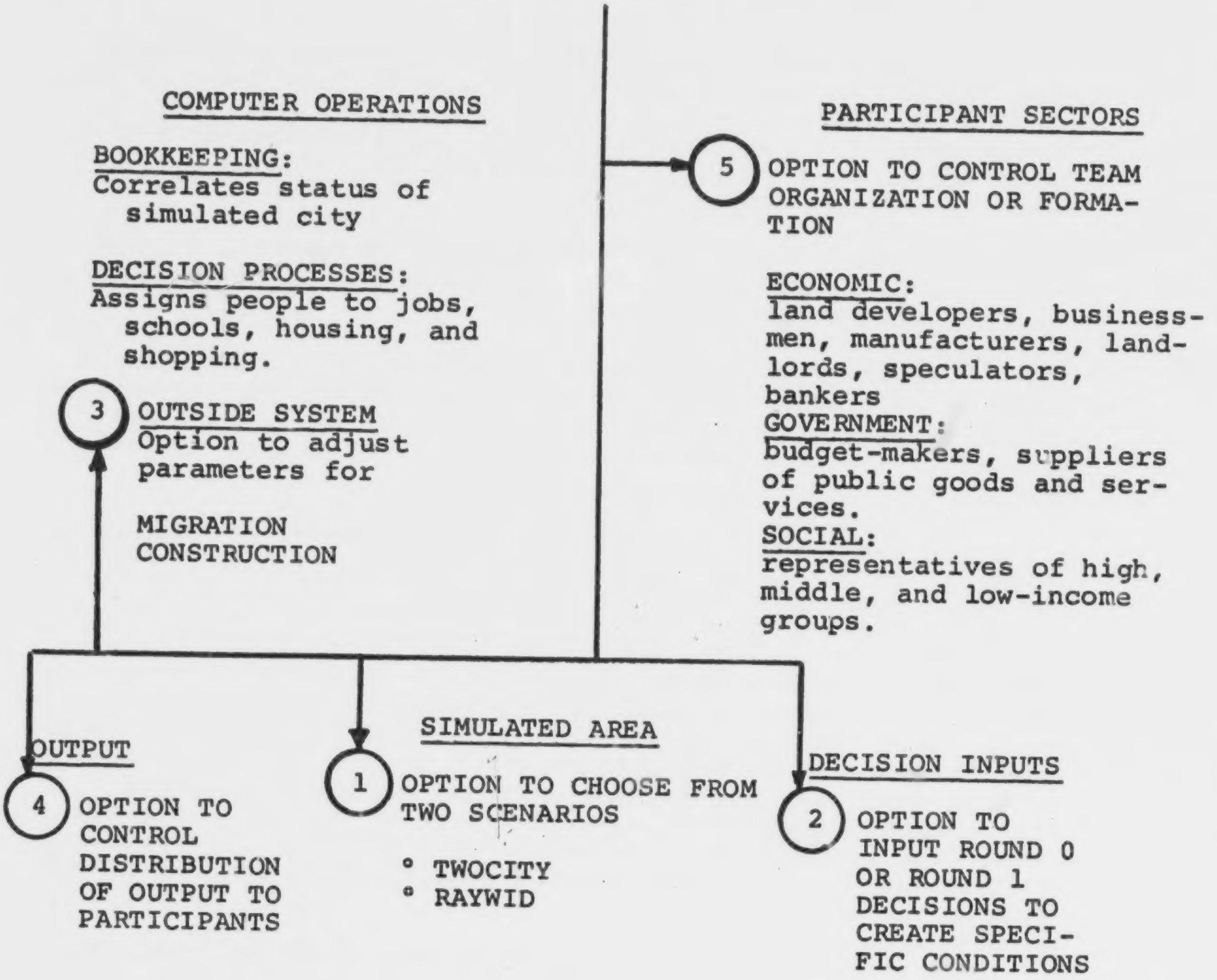
3. Adjust parameters for the outside system. Specify the number of in-migrants or allow local construction industries.

4. Control the way information (computer output) is distributed among the players. A Director might want to keep some of the detailed information to himself and sell it to players who are able to pay the research fees established by the Director.

5. Control the way players are assigned to teams. Individual players might be assigned as members of several teams (in two or more sectors) or they might be assigned to only one team.

Figure 4

DIRECTOR OPTIONS


COMPUTER OPERATIONS
BOOKKEEPING:
Correlates status of simulated city
DECISION PROCESSES:
Assigns people to jobs, schools, housing, and shopping.
3
OUTSIDE SYSTEM
Option to adjust parameters for
MIGRATION
CONSTRUCTION
PARTICIPANT SECTORS
5
OPTION TO CONTROL TEAM ORGANIZATION OR FORMATION
ECONOMIC:
land developers, businessmen, manufacturers, landlords, speculators, bankers
GOVERNMENT:
budget-makers, suppliers of public goods and services.
SOCIAL:
representatives of high, middle, and low-income groups.
OUTPUT
4
OPTION TO CONTROL DISTRIBUTION OF OUTPUT TO PARTICIPANTS
SIMULATED AREA
1
OPTION TO CHOOSE FROM TWO SCENARIOS
° TWOCITY
° RAYWID
DECISION INPUTS
2
OPTION TO INPUT ROUND 0 OR ROUND 1 DECISIONS TO CREATE SPECIFIC CONDITIONS

4. THE DIRECTOR AND THE COMPUTER

It is important for the Director to distinguish between the "technical round" and the "game room round" This section contains information about rounds and the sequence of computer operations.

4.1 The Round

The director/operator must deal with two rounds: the player's output is known as a "round", and the data base stored in either a tape file, or as it remains in the computer system, is a "round" of data. Players make decisions from a data base numbered the same as the round of output with which they are playing.

Thus, care should be taken in discussing "rounds" with the players, computer installation staff, or the operator to avoid misunderstandings.

The technical round involves computer processing of the players' decisions and the subsequent simulation which traces a year's activity, while the players or the game-room round entails the players interacting in making decisions.

A Round 0 data base is only produced by the execution of the LOAD program. LOAD produces no round of output. Consequently, once LOAD has generated an initial data base, a subsequent round of output along with a subsequent round's data base (both of which have the same round number) can only be produced through the execution of the simulation on the previous round's data base (perhaps altered by EDIT). Thus, only execution produces a new round of output and a new round's data base, both numbered the same. An altered round is the data base generated by the execution of the EDIT (input processing) program to the players' round decisions. That data base retains its round number; e.g., EDIT executed on the Round 1 data base generates an altered Round 1 data base.

In a typical play of the model the computer round begins with the EDIT program processing player inputs. This program rejects any improper or invalid decisions and records the changes specified by the correct decisions.

4.2 Sequence of Computer Print-Out

Although sections of the computer output can be distributed in any order and in any combination to players, it is printed in a fixed order with which the director should become familiar. The overall order of output is:

1. Migration
2. Water System
3. Employment
4. Commercial Allocation
5. Social Sector
6. Economic Sector
7. Social and Economic Summaries
8. Government Detail
9. Summary Statistics
10. Maps

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Within each of these major output sections there are several subsections. An additional section of print-out results from the processing of decisions on a data base. That print-out, called EDIT, has no fixed sequence within it; the order of decision input is the order in which EDIT processes and lists player and director decisions. The EDIT print-out is separate from the print-outs listed above. These print-outs reflect the simulated region's status in response to the previous year's data base and any changes made to it through EDIT.

Each subsection of output has its own title, but on every subsection the heading for the data base and the round number are printed. A list of the titles of print-out sections in the order in which they are printed and a description of each are given below and are summarized in Figure 5.

Print-Out Section	Description
1. Migration	
Environmental Indexes	For each class which can live on each residence parcel, this shows the value of each component of the environmental index based on last round's pollution index, MS use index and school use index and this round's residence quality rent, tax rates, and welfare rate

Figure 5

RIVER BASIN MODEL OUTPUT

1. **Migration**
    - 1.1 Environmental Indexes
    - 1.2 Personal Indexes
    - 1.3 Dissatisfaction Cutoffs
    - 1.4 Migration Detail
    - 1.5 Migration Statistics
    - 1.6 Migration Summary
2. **Water System**
    - 2.1 Water User Effluent Content
    - 2.2 River Quality During Surface Water Process
    - 2.3 Water User Costs and Consumption
    - 2.4 Coliform and Pollution Index Values
3. **Employment**
    - 3.1 Employment Selection Information for PL Class
    - 3.2 Employment Selection Information for PM Class
    - 3.3 Employment Selection Information for PH Class
    - 3.4 Part-Time Work Allocation for PH Class
    - 3.5 Part-Time Work Allocation for PM Class
    - 3.6 Part-Time Work Allocation for PL Class
    - 3.7 Employment Summary
4. **Commercial Allocation**
    - 4.1 Personal Goods Allocation Summary
    - 4.2 Personal Services Allocation Summary
    - 4.3 Business Goods Allocation Summary
    - 4.4 Business Services Allocation Summary
    - 4.5 Government Contracts
    - 4.6 Terminal Demand and Supply Table
    - 4.7 Terminal Allocation Map
5. **Social Sector**
    - 5.1 Dollar Value of Time
    - 5.2 Social Decision-Maker Output
    - 5.3 Social Boycotts
6. **Economic Sector**
    - 6.1 Farm Output
    - 6.2 Residence Output
    - 6.3 Basic Industry Output
    - 6.4 Commercial Output
    - 6.5 Economic Boycott Status
    - 6.6 New Construction Table
    - 6.7 Land Summary
    - 6.8 Loan Statement
    - 6.9 Financial Summary
7. **Social and Economic Summaries**
    - 7.1 Number of Levels of Economic Activity Controlled by Teams
    - 7.2 Employment Centers
    - 7.3 Economic Control Summary for Teams
    - 7.4 Social Control Summary for Teams
    - 7.5 Social Control Summary Totals
    - 7.6 Economic Graphs for Teams
    - 7.7 Social Graphs for Teams
8. **Government Detail**
    - 8.1 Assessment Report
    - 8.2 Water Department Reports
    - 8.3 Sampling Station Report: Point Source Quality
    - 8.4 Sampling Station Report: Ambient Quality
    - 8.5 Utility Department Report
    - 8.6 Utility Department Finances
    - 8.7 Municipal Services Department Report
    - 8.8 Municipal Services Department Finances
    - 8.9 Municipal Services Department Construction Table
    - 8.10 Planning and Zoning Department Report
    - 8.11 School Department Report
    - 8.12 School Department Finances
    - 8.13 School Department Construction Table
    - 8.14 Highway Department Finances
    - 8.15 Highway Department Construction Table
    - 8.16 Rail Company Report
    - 8.17 Bus Company Report
    - 8.18 Chairman Department Finances
    - 8.19 Tax Summary
    - 8.20 Financial Summary
9. **Summary Statistics**
    - 9.1 Demographic and Economic Statistics
10. **Maps**
    - 10.1 Personal Goods Allocation Map
    - 10.2 Personal Services Allocation Map
    - 10.3 Business Commercial Allocation Map
    - 10.4 Municipal Service Map
    - 10.5 School Map
    - 10.6 Utility Map
    - 10.7 Water Usage Map
    - 10.8 Water Quality Map
    - 10.9 Municipal Treatment
    - 10.10 Municipal Intake and Outflow Point Map
    - 10.11 Surface Water Map
    - 10.12 Farm Runoff Map
    - 10.13 River Basin Flood Plain Map
    - 10.14 Farm Map
    - 10.15 Farm Assessed and Market Value Map
    - 10.16 Market Value Map
    - 10.17 Assessed Value Map
    - 10.18 Economic Status Map
    - 10.19 Highway Map
    - 10.20 Planning and Zoning Map
    - 10.21 Parkland Usage Map
    - 10.22 Socio-Economic Distribution Map
    - 10.23 Demographic Map
    - 10.24 Social Decision-Maker Map
    - 10.25 Topographical Restriction Map
    - 10.26 Government Status Map

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Print-Out Section	Description
Personal Indexes	For each class living on each residence parcel, this shows the value of each component of the personal index based on last round's time allocation, residential crowding, MS use index, and coliform bacteria index.
Migration Detail	For each residence parcel and for each class which lived on the parcel immediately before or after the migration program ran, this shows the number of Pl's in the class now residing on the parcel and of those who moved, why they moved and where they came from and went to.
Migration Statistics	Number of in-migrants, out-migrants, internal migrants, and natural population growth by jurisdiction and class.
Migration Summary	The number of Pl's who moved between or within jurisdictions by class, by jurisdiction and by reason for moving.
2. Water System	
Water User Effluent Content	For each economic activity and municipal water system, the volume of effluent dumped into the surface water and the amount of each pollutant in the effluent after the effluent has received any treatment.
River Quality During Surface Water Process	For each of the five stages in the surface water process and for the surface water on each parcel through which a river flows, this shows the water quality rating, the volume of water, and the amount of each pollutant present.

Print-Out Section	Description
Water User Costs and Consumption	This shows for each economic activity the amount of water which it required, the amount which it obtained from its normal source and the cost which it paid to purchase water, to treat its intake water, to recycle water and to treat its effluent.
Coliform and Pollution Index Values	Map showing, for each parcel containing surface water, the coliform count and the water quality rating. The pollution indexes for such parcels and for parcels bordering parcels containing surface water are also shown.
3. Employment	
Employment Selection Information for Low-Income Class	Tabular output showing the place of residence of all Pl's, their employers, the number of Pl's not employed and employed by each employer, the salary of each employer, the time units consumed in transportation to work, the cost of using an auto to go to work, the costs using a bus and/or rail to go to work, and the route used to travel to work whether by auto or public transit.
Employment Selection Information for Middle Income Class	Tabular output showing the place of residence of all Pl's, their employers, the number of Pl's not employed and employed by each employer, the salary of each employee, the time units consumed in transportation to work, the cost of using an auto to go to work, the costs using a bus and/or rail to go to work, and the routes used to travel to work whether by auto or public transit.

Print-Out Section	Description
Employment Selection Information For High Income Class	Tabular output showing the place of residence of all Pl's, their employers, the number of Pl's not employed and employed by each employer, the salary of each employer, the time units consumed in transportation to work, the cost of using an auto to go to work, the costs using a bus and/or rail to go to work, and the routes used to travel to work whether by auto or public transit.
Part-Time Work Allocation For High Income Class	Tabular list of residence location of part-time workers, their employers, the number of part-time units spent working, and the yearly salary rate.
Part-Time Work Allocation for Middle Income Class	Tabular list of residence location of part-time workers, their employers, the number of part-time time units spent working and the yearly salary rate.
Part-Time Work Allocation for Low Income Class	Tabular list of residence location of part-time workers, their employers, the number of part-time time units spent working and the yearly salary rate.
Employment Summary	Information by class and total for the number of Pl's employed at their design level or at lower levels, the number unemployed, the total number of Pl's, the part-time units worked, and the number of jobs full time that were not filled by the local labor force.

4. Commercial Allocation

Personal Goods Allocation Summary	Tabular output showing the identification number assigned to each PG establishment, its

Print-Out Section	Description
	location, owner, level, effective capacity, actual capacity used, price, and gross sales. For each customer it shows the store to which it is assigned, the customer location and type or class, the customer's owner, the consumption units (including those for maintenance and recreation), transportation costs (shadow costs in the case of residences) the purchase cost (total cost in the case of residences), and total cost.
Personal Services Allocation Summary	This is identical in format to the Personal Goods Allocation Summary but gives details regarding personal services.
Business Goods Allocation Summary	For businesses which require business goods, the format is the same as for personal goods. In addition, there is a section called Government Contracts which shows, for each school and MS department, how many consumption units it purchases from each business goods establishment.
Business Services Allocation Summary	This is identical in format to the Business Goods Allocation Summary but gives details regarding business services.
Terminal Allocation Summary	Tabular list of the location, business type (land use), and terminal requirements of each terminal user. Each terminal is assigned an identification number and its location, level, and usage are noted.

Print-Out Section	Description
Terminal Allocation Map	Map showing the code number of the terminal to which each terminal user in the local system is assigned.
5. Social Sector*	
Dollar Value of Time	This table shows, by team and by class, the dollar value of a time unit spent in travel.
Social Decision-Maker Output	By jurisdiction, by social decision-maker, and by class, a table in which each social characteristic is a row and each residence parcel is a column. The characteristics are descriptive and financial.
Social Boycotts	Detail on who is boycotting, what function they are boycotting, and similar details about social boycotts appear on this output.
6. Economic Sector**	
Farm Output	Tabular list, one row per farm, showing the farm code number, farm type, number of parcels comprising the farm, number of percents of parcels comprising the farm, the farm's fertilizer level, normal income, actual income, land taxes, and total net income.

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*The dollar value of time prints a table for each jurisdiction, although at this time the value is set for a team and class without regard to jurisdiction. The rest of the social detail prints in order of jurisdiction number, within that in alphabetical order, and within that in order of class (low first, high last). Output for any classes which a team does not control in a jurisdiction is not printed. Likewise, a class having no boycotts receives no boycott output.

**The economic output prints by team in alphabetical order. All of a single team's output is printed before the next team's output begins. A team for which a section of output is irrelevant does not receive that section of output. For example, a team with no residences receives no residence output. Likewise, a team which has no loans outstanding as either a debtor or a creditor does not receive a loan summary. All active teams receive financial summaries.

Print-Out Section	Description
Residence Output	Tabular list of descriptive and financial information about each residence parcel which the decision-maker controls.
Business Output	Tabular list of descriptive and financial information about each business which the decision-maker controls. All basic industries are grouped together and precede the group of personal commercial and business commercial.
Construction Industry Output	Tabular list of descriptive and financial information about each construction industry which the decision-maker controls.
Construction Industries' Contract Table	Description of all contracts made by construction industries controlled by the decision-maker.
Economic Boycott Status	Detail on all boycotts in which the decision-maker is either the party boycotting or the party being boycotted.
New Construction Table	Detail on all construction contracts in which the decision-maker is the contractee.
Land Summary	Tabular list of the location of parcels owned by a team, their assessed value, percent that is undeveloped and private, the taxes on undeveloped land, the percent publicly developed and undeveloped, the percent undevelopable because of topographical constraints, the utility capacity available and used.

Print-Out Section	Description
Loan Statement	Tabular list showing borrower, lender, interest rate, years remaining on the loan, the original principal, and the annual payment.
Financial Summary	A cash flow statement showing expenditures and income, a portfolio of conservative and speculative stocks, a balance sheet of assets and liabilities, and the amount which the decision-maker can borrow.
7. Social and Economic Summaries	
Number of Levels of Economic Activity Controlled by Teams	A table listing the number of levels of each economic activity controlled by each team.
Employment Centers	Table showing the locations, number of job openings, number of Pl's hired, and salaries offered by Federal-State Employers; table showing, for each local government employer, the location of its employment center.
Economic Control Summary*	For each non-farm economic activity, this table shows its location, type and operating level of activity, production index (0-100) or occupancy rate (0-120), net income, and rate of return.

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*This table prints for each economic team in alphabetical order.

Print-Out Section	Description
Social Control Summary*	For each class living on each parcel controlled by a single two-letter social decision-maker, this table shows the residence location, class, gross income per worker, family savings and total dissatisfaction (quality of life index).
Social Control Summary	By jurisdiction and by class, the number of P1's controlled by each social decision-maker.
Economic Control Summary	This prints two graphs for each economic decision-maker, in alphabetical order. The first is, for up to ten rounds, the average net income from the team's economic activities each round, expressed as a ratio of the first round's net income. The second is a ten-round history of the average rate-of-return of the team's economic activities, expressed as a percent.
Social Control Summary	This prints two graphs for each social decision-maker, in alphabetical order. The first is a ten-round history of the average net income earned by each class which the team has controlled. The second is a ten-round history of the average quality-of-life index of each class which the team has controlled.

---

*This table prints for each social decision-maker in alphabetical order.

Print-Out Section	Description
8. Government Detail*	
Assessment Report	List of assessment ratios, special assessments and other policies set by the Assessor.
Water Department Reports	List of intake and outflow treatment plant locations, levels, types, capacities, operating costs, volume treated, income, intake and outflow point locations, prices charged to municipal water users, pollutant concentration in municipal effluent (for those districts which are sampled).
Sampling Station Report: Point Source Quality	For those economic activities whose effluent is sampled by the local government, this shows the volume of effluent and the concentration of each pollutant after any treatment.
Sampling Station Report: Ambient Quality	For any parcel on which the jurisdiction measures the quality of the surface water leaving the parcel, this output shows the concentration of each pollutant.
Utility Department Report	Tabular list of utility plants, their location, level, units installed from each plant, units served, total operating costs per unit, and income derived from charges. Also listed is the charge per utility unit to customers, undeveloped land and outstanding bonds.

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*A department's output is printed for all jurisdictions before the next department's output is printed.

Print-Out Section	Description
Utility Department Finances	Summary of all current and capital revenues, expenditures, and new balances.
Municipal Services Department Report	Tabular list of MS locations, maintenance levels, value ratios, effective capacities, loading (units of capacity used), number PL and PM's working, and the MS use indexes. Also shown are the salary levels, contracts to purchase BG and BS, the locations of undeveloped land, and outstanding bonds.
Municipal Services Department Finances	Summary of all current and capital revenues, expenditures, and new balances.
Municipal Services Department Construction Table	For each MS construction or demolition, this shows the location of the construction firm, the MS location, the status of construction, the old and new level of the MS, the contracted price, the maintenance level, and the number of PL's and PM's assigned to work at the MS.
Planning and Zoning Department Report	Total jurisdiction population, total amount of parkland, outstanding bonds, and capital revenues, expenditures, and new balance.
School Department Report	Tabular data on school unit locations, levels, maintenance levels, value ratios, students attending, teachers, student-teacher ratios, and use indexes. Also data on undeveloped land, BG and BS contracts and cost of purchases, adult education summary, and several summary school statistics.
School Department Finances	Summary of all current and capital revenues, expenditures, and new balances.

Print-Out Section	Description
School Department Construction Table	For each school construction or demolition, this shows the location of the construction firm, the school building location, the status of construction, the old and new level of the school, the contracted price, the amount of federal-state aid used, the maintenance level for the school, and the number of PM's and PH's assigned to work at the School.
Highway Department Report	A financial report showing capital and current expenditures and revenues, outstanding bonds, a summary of maintenance levels and expenditures by road type, a summary of road conditions, a terminal status report, a list of undeveloped land, and a status report on available federal-state aid.
Highway Department Construction Table	For each road or terminal construction or demolition, this shows the construction firm, the location of the road or terminal, the status, the old and new level, the contracted price, and the dollar amount of federal-state aid used.
Rail Company Report	A financial report showing capital and current revenues and expenditures, outstanding bonds, employment costs, the amount and condition of rolling stock, the fare structure, passengers and total fares by route, and the number of passengers using each segment of each route.

Print-Out Section	Description
Bus Company Report	A financial report showing capital and current revenues and expenditures, outstanding bonds, employment costs, the amount and condition of rolling stock, the fare structure, passengers and total fares by route, and the number of passengers using each segment of each route.
Chairman Department Finances	This shows the welfare payment per unemployed worker and the financial summaries for municipal services, schools, highways, planning and zoning, utilities, and the chairman's account. Also included are the Chairman's outstanding bonds.
Tax Summary	Tabular list showing by the eight types of local tax bases, the dollar amount of the tax base, the tax rate, and the revenue generated.
Financial Summary	Tabular list, for each department, of current and capital appropriations, federal-state aid, total revenue, total expenditures and final surplus or deficit.

9. Summary Statistics

Demographic and Economic Statistics	Tabular list by jurisdiction of population and its characteristics, land usage, housing, employment, earnings, income from the national economy, outflows to the national system, and national business cycle effects.

Print-Out Section	Description
10. Maps	
Personal Goods Allocation Map	Map showing the locations and code numbers of all personal goods establishments, locations of all PG users, and the code number of the PG to which each PG user is assigned.
Personal Services Allocation Map	Map showing the locations and code numbers of all personal services establishments, locations of all PS users, and the code number of the PS to which each PS user is assigned.
Business Commercial Allocation Map	Map showing the locations and code numbers of all business goods and business services establishments, locations of all BG and BS users, and the code numbers of the BG and BS to which each BG and BS user is assigned.
Municipal Service Map	Map showing the locations of MS's and their districts, the locations of economic activities, the number of MS units drained by each economic activity and MS use indexes.
School Map	Map showing the locations of schools and their districts, school use indexes, and the number of children on each residence parcel attending public and private schools.
Utility Map	Map showing the locations of utility plants and their districts, the number of utility units installed on each parcel, and the number of utility units drained on each parcel.

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Print-Out Section	Description
Water Usage Map	Map showing the locations of economic activities, the percent recycling at basic industries, and the type and level of basic industries' effluent treatment plants.
Water Quality Map	Map showing the locations of economic activities, the surface water quality on those parcels having surface water, and the pollutant which caused the water quality rating.
Municipal Treatment Plant Map	Map showing locations, types and levels of municipal intake and outflow treatment plants.
Municipal Intake and Outflow Point Map	Map showing locations of municipal intake and outflow points and the utility districts which they serve.
Surface Water Map	Map showing, for each parcel having surface water, the volume of water on the parcel, its rate of flow, and the percent of the surface area of the parcel consumed by water.
Farm Runoff Map	Map showing for each farm its type and where its runoff flows into the surface water.
River Basin Flood Plain Map	Map showing the locations of river basins, the dam priority of each river basin, and the flood susceptibility of each parcel in the river basin.
Farm Map	Map showing the location of each farm, its owner, its code number, the percent of each farm parcel which is in farm use, the type of farm, and its fertilizer level.

Print-Out Section	Description
Farm Assessed and Market Value Map	Map showing, for each farm parcel, its assessed and market value and the percent of the parcel which is in farmland.
Market Value Map	Map showing, for each privately-owned non-farm parcel, the market value of 100% of the land, the market value of the privately-owned buildings, and the total market value of the privately-owned land and buildings.
Assessed Value Map	Map showing, for each privately-owned non-farm parcel, the assessed value of the privately-owned land, the assessed value of the privately-owned buildings, and the total assessed value of the privately-owned land and buildings.
Economic Status Map	Map showing the economic sector owner of each privately-owned non-farm parcel, its zoning, the type and level of economic activity, the level of utilities installed, and, for every parcel, the percent of the parcel which is privately-owned and undeveloped.
Highway Map	Map showing the locations and types of roads and terminals and the locations, types, and levels of non-farm economic activities.
Planning and Zoning Map	Map showing the zoning classification of those parcels which are zoned, the percent of each parcel which is parkland, and the percent of each parcel which is public institutional land.

Print-Out Section	Description
Parkland Usage Map	Map showing the percent of each parcel which is in parkland or public institutional use, the population served by the park, and the park's use index.
Socio-Economic Distribution Map	Map showing, for each residential parcel, the type and level of housing and the number of P1's in each class living there.
Demographic Map	Map showing the population (in 100's), percent occupancy, and quality index (QI) for all residential parcels, and the value ratio (VR) for all private non-residential developments.
Social Decision-Maker Map	Map showing, for each class living on a residential parcel, the social decision-maker which controls the class on that parcel.
Topographical Restriction Map	Map showing the percent of each parcel which is undevelopable due to topographical or other restrictions (e.g., mountains or military bases).
Government Status Map	Map showing the locations and levels of schools, municipal services, utility plants, roads, and terminals.

5. OPERATING THE MODEL

This section contains supplementary information for the Director which is related to the guidance of a play and of players.

5.1 Running the Round

In a round of play participants analyze their output, maintain game-room communications, develop short and long term objectives, and submit their formal decisions. While the Players' Manual supplies the information and basic mechanics that the players require to complete the first task, the Director commands a large amount of influence over the other three phases of the decision-making process.

There is little danger of rigidity in starting a play within a certain framework. The model is flexible enough to accommodate any degree of restructuring from one round to the next. On the other hand, a laissez-faire approach to directing the play may be appropriate and clearly possible. Discretion should be exercised, however, in allowing first-time players to begin in this fashion as the absence of all framework could lead to lack of understanding and confidence.

Since any game objective implies a certain team formation, communications network, and strategy formulation, the Director should devote some time to organizing these areas. The communications network has its foundation in the logistics of the play (where the teams are located and their proximity to other sectors, etc.) and in how the output is distributed. Additional means of communication include those provided by a mass media, governmental regulatory agencies, and ad hoc "citizens" committees.

5.2 Options and Strategies

Strategy formulation, which encompasses the total environment of the decision-making process, is an area in which the Director can best instruct and "guide" the participants. The Director can exhibit as much creativity and imagination in terms of game motivation as possible. This section provides suggestions to assist the Director in enriching the program in ways which will respond to and cultivate participants "real world" interests.

The Director can expect to be called on for discussion of strategies as an integral part of the decision-maker's approach to his actions.

Given any game format, a limited subset of strategy formulations is established. Therefore, selection of a game format implies player assignment to roles which have recognizable objectives. Thus, the Director should be wary of restrictions to flexibility which a particular format prescribes. On the other hand, the specification of a format may enable the participants to involve themselves in the game, a situation which may not have obtained without early direction. Moreover, once involvement occurs new formats and strategies will undoubtedly evolve.

Seven format suggestions are listed below. None are developed fully here and there are no detailed examples of the manner in which they would be implemented. Nevertheless, the brief descriptions should enable the Director to conceptualize the structures implied in the formats. Unquestionably, this area will become much more comprehensible to the Director when he acquires a working knowledge of the model and its processes.

One. Develop an analogy between the dynamics of the game and real world problems of decision-making.

Once the participants comprehend the functions of the decision-making teams, an effort should be made to interpret their output in terms of real-life situations. Utility units become kilowatt-hours; adult education becomes vocational training, on-the-job training, and the pursuit of college degrees.

The players should consider their very localized interests and competitive relationships. Finally, each problem can be identified as though it were a real world phenomenon which can only be acted upon through real world means. For example, poor police service results in more crime. What solutions are available: hire more police, provide more facilities, etc.?

Two. Deal with real world issues as though unrestricted by the components of the game. (The converse of One.)

Insure that the players have little or no prior knowledge of the game. Let them formulate the issues and problems of urban systems, particularly as they relate to the individual participant: should public schools be eliminated: should neighborhoods have autonomy over school boards; what good is a metropolitan government; are corporations economically feasible?

Isolate each issue and illustrate through a segmented play of the game how such a program or situation could be implemented; identify the impediments to implementation, and the simulated consequences of the action.

For example, it is posited that a natural (or man-made) disaster of catastrophic proportions would completely disable a city, precluding any reconstruction or even survival. The Director could put in numerous demolitions and decreases in levels of hiring capacities for departments and then run several "years" of simulation. The game's activity following such an event would present a basis for provocative debate around such questions as "what would have happened if ....?" This debate in turn, would generate more demonstrations and more real world involvement.

Three. Operate all functions to achieve goals called for in a Master Plan.

Communities often develop Master Plans to guide future growth. While the players would be required to participate completely in the decision-making if this format is used, they will soon become aware of how inflexible and limited their options are. Each potential decision from all sectors would be subjected to careful scrutiny to insure that nothing would cause deviation from the path intended to lead to a common objective.

Analysis of the decisions, the development of the plans, and evaluation of the psychological effect of narrowing player motivations are three fertile areas for growth of ideas and interpretations.

Four. Restrict the evaluation techniques of each decision-maker to those of cost-benefit analysis.

For some decision-makers, this specification requires that they translate intangibles into dollars-and-cents terms. The assumptions and philosophies they use in making this first step of the total analysis merit classroom investigation. Note that applying time-dollar-value decisions to the social sector is a microcosm of this approach.

Under this format the participants must thoroughly understand their roles and the game components which affect their activities, population units, and the like. Subsequently, each alternative decision can be processed in a fixed pattern: any possible move is sorted into a cell with all other actions having related effects; the combined costs (such as those from increased prices of personal goods if a shopping boycott is begun, or decreased current expenditures from not improving the municipal services use index) must be compared to both projected immediate benefits such as loss of revenue in economic sector due to lower maintenance expenditures caused in part from the second action stated above, and long-term effects (again for the second case, outmigration of population units).

The manner in which this format is described implies that most decision-making is done by making a cost-benefit analysis. This is not necessarily the lesson or intention of this format, as strict adherence to this approach removes intuitive responses and probably encourages a strictly ordered play. Obviously, there are drawbacks as well as benefits to this format if such a result is obtained.

The following two examples suggest game formats which are actually sub-formats of a play. Thus, either one could be incorporated while a larger theory is applied to the whole play.

Five. Operate the government departments autonomously.

Remove the larger bureaucratic structure of the government by making each department responsible only to itself. The departmental decision-makers could be either appointed by the game director or elected individually by the social sector and/or the economic sector. In either circumstance, intense self-interests and competitive instincts could develop for each department and even for each jurisdiction. The Director should control all departmental financing.

Some of the consequences of this format include the alliances between a social or an economic team and a particular department.

Six. Organize the economic teams so that they act as a single unit.

In effect, the economic sector becomes one team. This format, where the economic sector is an oligopoly, could easily evolve to many illustrations of other nations' political and economic structures. Regardless of whether or not lessons on political economy are important to the Director, perpetual confrontation between sectors is obviated. The consequences of these confrontations should provide several experiences in the machinations of power.

A variation of this economic format is the collusion of social teams into a strong civic organization and/or political power base. Both sectors would then be vying for control of the government sector which holds monetary and other rewards for the controller.

Seven. Encourage a zero population growth policy.

By exercising the inmigration option, the Director can effectively stabilize the population. This would allow the players to adopt a zero population growth policy and attempt to carry it out. The players might be convinced that the best policy they can undertake as a group is to increase the satisfaction of the people living in the local system. Thus all attention could be placed on the quality of decisions given an overall population level.

To carry out such a policy, the economic incentives required, the population regulations needed, the economic growth (quantity) foregone, and the public services levels required would be illustrated. In an environment with a stable population, the transportation decisions and land use decisions would be linked together to provide a played-determined optimal locational pattern within the constraints provided by the initial starting conditions and the available capital.

The players would be made aware of the difficulties involved in maintaining a standard of living in a stagnant economy. The outside system would take on a different meaning since most of the players' investments would have to be made in conservative and speculative outside investments. The development of a favorable balance of trade between the local and outside system would become crucial. Outmigration would have to be guarded against.

In summary, the players would be faced with a unique public and private policy challenge that has not been afforded to many real life decision-makers on a voluntary basis.

Even after a format is fitted to a play and the players are cognizant of the objectives of the game, some may still encounter difficulty in organizing their individual actions. While the circumstances of player failure to operate in a decision-making context is unlikely, a particular strategy formulation technique is included to aid the Director if such a barrier is encountered.

The strategy is simply a sequence of actions to be taken by an individual player: identify a problem; probe it with questions; search the output for answers; develop alternative decisions; implement some of them; and reanalyze the problem on the basis of those decisions. The particular context from which the following examples are drawn is a format equivalent to the first one above and to the standard formation of teams into separate sectors, with separate control and responsibilities within each sector.

Players should be able to identify dozens of problem areas which could be analyzed in a similar fashion. Consequently, the Director may wish to sketch a master form from which the players could proceed to develop decisions as a learning exercise.

5.3 Director Inputs

The Director has the option to take an active or passive part in the operation of the model. Since the Director may act for the outside system and exert some of its influences on the local system, the Director may demolish buildings (representing natural disasters or riots requested by the social sector) by using the same input format described for the players. The Director is free to make any decision that any of the players may make. For example, he might want to transfer money from a private team's account to the account of the Chairman or the outside system to represent a fine or a major theft.

In addition to the power of making any player-type decision, the Director also has the opportunity to make a number of decisions not available to the players. These director-specific decisions are in one of two broad categories: Outside the system changes and inside the local system changes.

Figure 6 shows the types of decisions that may be made under these two broad categories.

1. Specify In-Migrants - Acting as the Outside System, the Director may affect the local system in a general way by specifying the number of in-migrating P1's by class that will attempt to move into the local system. If this input is used, it overrides the number of P1's that would normally be attracted to the local system as a function of the local dynamics (jobs available and population size).

2. Cash Transfer - The Director may transfer cash to or from any local system account (economic team, social class on a parcel, or government department). This can be used to simulate new federal grants, state fines, etc.

3. Float Bonds - the Director will usually float a capital bond after the referenda to do so has achieved the needed social sector support.

4. Assure Land Purchase - the Director can exercise complete control over the unowned land market through his option to accept or reject land bids. Thus the Director can use a number of mechanisms for having the players acquire land that is initially in the hands of owners outside the local system. Competitive open bids, sealed bids, or unsolicited bids might be employed for various land parcels and at various times during the play.

Figure 6

DIRECTOR-SPECIFIC DECISIONS IN THE RIVER BASIN MODEL

Outside the Local System Changes

General

1. Specify Number of In-Migrants (by income class)

Specific to Team

2. Cash Transfer (any amount to any economic team, P1 class on a parcel, or government account)
3. Float Bonds (for any legitimate government account)
4. Assure Land Purchase (by any economic or legitimate government department)

Inside the Local System

General

5. Allow or Forbid Local Construction Industries
6. Set Dam Priority (by River Basin)
7. Set Flood Severity (by River Basin)

Parcel Specific

8. Create or Remove Pre-empt Land (undevelopable land)
9. Set Water Quality for a Lake (an index value of from 1 to 9)
10. Set Miscellaneous Pollution to Be Dumped on a Parcel (by the seven pollutant types)
11. Set the heading which prints on the output

5. Local Construction Industries - The Director has the option to allow a new type of private economic activity (local construction industry firms) in the local system. This is usually not recommended unless the play will go beyond five rounds, because there is a year time lag for all construction projects if the local construction industry option is employed. The major advantage of allowing local construction industries is to keep some of the construction expenditures within the local system in the form of purchases of labor and goods and services.

6. Dam Priorities - The Director may set a dam priority for all the dams within a River Basin area. Of the three dam priority options, one favors recreation at the expense of flood control with water quality effects remaining neutral, one has a positive effect on water quality control and is neutral to recreation and flood damage effects, and the third is very favorable to water quality and slightly favorable to flood control at the expense of recreation.

7. Flood Severity - The Director may set a flood damage level for a river basin. The damage done to particular developments within the basin area is a function of their type, their location in the flood plain, and the dam priority (also set by the Director).

8. Undevelopable Land - Pre-empt or undevelopable land may be loaded as part of the local system or input by the Director. It may represent federal land, institutional land, or land that is unusable because of topographical restrictions. The Director may convert pre-empt land to a usable classification if he wishes. This might represent large expenditures to fill in a bay or purchases from the federal government of a former military base.

9. Quality of Water in a Lake - The Director may specify the water quality rating for any lake parcel. This will impact on the major recreation areas in the nearby vicinity.

10. Miscellaneous Pollution Dumped on a Parcel - The Director may wish to represent the exact amount of pollution generated by a major polluter in the local system. He may do this by specifying the amount of each of the seven pollutant types plus the volume of water that is dumped into the water system at a particular parcel location.

11. Set the Heading - The Director may wish to uniquely identify a round of output or a data base by giving its output a special heading. For example, two different groups may be using the model separately but with the same initial data base. The director might lable one group's data base, "TWO CITY--GROUP A" and the other group's "TWO CITY--GROUP B."

DIRECTOR'S INPUT EXPLANATION FORM

Type of Decision	Code	Decision Maker	a	b	c	d
Outside System						
Specify Number of In-Migrants	$OTHER	OU	INLO, INMID, INHI	number of Pl's to in-migrate		
Set the Output Heading	$HDNG					

The $HDNG card should be followed by a card on which the desired heading is punched. The program accepts as the heading whatever is on the first card following the $HDNG card.

DIRECTOR'S SUMMARY INPUT EXPLANATION FORM

Type of Decision	Code	Decision Maker	a	b	c	d	e
Transfer Cash	$CASH	OU or economic or social decision-maker or department and jurisdiction	C	receiver (economic or social decision-maker or OU or department and jurisdiction)	amount in dollars	giver's account (PVT if economic; class if social (H,M,or L); if department CAP or CUR)	receiver's account (PVT if economic; class if social (H,M,or L); if department, CAP or CUR)
	NOTE:	IF SOCIAL IS GIVER, LOCATION in column "f". IF SOCIAL IS RECEIVER, LOCATION in column "g".					
Float Capital Bonds	$OTHER	department receiving	BO	amount in $10,000's	25		
Assure Land Purchase	$PU	Decision-maker bidding	location	price in $1000's	OU	percent of parcel (0 if all)	1 to insure bid success

Type of Decision	Code	Decision Maker	a	b	c	d
Local Construction Industry	$OTHER	OU	NOCI or YESCI			
Set River Basin Dam Priority	$ODDS	OU	Dam priority A, B, or C	River basin code number		
Specify Flood Severity for a River Basin	$ODDS	OU	R	River basin code number	Flood level (1-100)	

Type of Decision	Code	Decision Maker	a	b	c
Change Pre-empt Land	$CVPT	OU	PLND (create) or RPLND (remove)	location	percent of parcel affected
Set Water Quality of Lake Parcel	$ENDS	OU	W	location of lake parcel	water quality rating (1-9)
Set Miscellaneous Pollution To Be Dumped on a Parcel	$ENDS	OU	P	location	A list enclosed in parentheses and separated by commas, of BOD (LB/MG), Chlorides (LB/MG), Nutrients (LB/MG), Coliform (parts), Temperature Deviation (Degrees), Oil & Floating Solids (0 if none, 1 if present), High Level Wastes (0 if none, 1 if present), Volume of water dumped (MGD)

An example of the miscellaneous pollution input is:
$ENDS/=OU/P, 7832, (50, 55, 40, 60, 12, 0, 1, 25)

5.4 General Note on Inputs

The Director should emphasize the need for players to carefully follow the steps required for a valid input. Two types of errors are most common. The first involves coding errors, such as the improper scaling of numbers. Players should be reminded to double-check their coding forms before submitting them for the EDIT program. The second type usually results from players not making sure that the requirements necessary for the effecting certain types of decisions do in fact prevail. Each participant is provided with a detailed explanation of the input procedure.

Besides preparing his own inputs, the Director should oversee the players' input procedure in order to limit the number of mistakes they make.

The coding of decisions for input to the computer should be conducted with precision. Failure to correctly code or punch decision information will result in failed action and considerable disappointment and frustration.

5.5 Coding and Punching Decisions

In order to input a decision, a player or the director must keypunch an input card with a decision message in the following form:

`$CODE/=DM/a,b,c,d,......`

1. The first item of information in the line ($CODE) is the one of 20 general decision codes. This code tells the general type of decision being made. A dollar sign ($) is the first symbol in all general decision codes. The general decision codes are:

		Govt.	Soc.	Econ.	Dir.
1.	$PU	x		x	x
2.	$CVPT	x		x	x
3.	$OTHER	x		x	x
4.	$OUBLD	x		x	x
5.	$BUILD	x		x	x
6.	$CASH	x	x	x	x
7.	$TIME		x		x
8.	$BYCT		x	x	x
9.	$VALUE		x		x
10.	$TAXES	x			x
11.	$ASMNT	x			x
12.	$REDIST	x			x
13.	$FSA	x			x
14.	$ROUT	x			x
15.	$RAIL	x			x
16.	$WRBLD	x		x	x
17.	$WRPRC	x			x
18.	$ODDS	x		x	x
19.	$ENDS	x		x	x
20.	$HDNG				x

2. A slash sign (/) always follows the decision code.

3. The second item of information for a decision is the identification of the decision-maker. An equal sign (=) is used to preface the decision-maker identification code. The decision-maker codes are:

A . . . Economic -- number of teams

AA . . Social -- number of teams

CH1 . . Chairman -- number of jurisdictions
AS1 . . Assessment -- number of jurisdictions
SC1 . . School -- number of jurisdictions
MS1 . . Municipal Services -- number of jurisdictions
PZ1 . . Planning and Zoning -- number of jurisdictions
UT1 . . Utility -- number of jurisdictions
HY1 . . Highway -- number of jurisdictions
BUS . . Bus Company
RAIL . Rapid Rail Company

OU . . Outside -- Used by the game director

4. The decision-maker code is followed by a slash mark (/).

5. The remaining information concerning the decision is printed after the second slash and is separated by commas. The blank spaces are ignored in the decision-information. For example, the following information is identical to the computer:

```
$CVPT/=A / S, 72 40 , 26 , 51 , 102

$CVPT=A/S,7240,26,51,102
```

The information following the second slash varies by the type of decision. For the following explanations assume the format:

```
$CODE/=DM/a,b,c,d, etc.
```

here "a" is the first item of information after the second slash, "b" is the second item of information, etc.

6. If an asterisk is typed on an input card, all of the punched columns to the right of the asterisk are ignored by the input program. This option is useful when the director wishes to describe a decision, such as during a demonstration of the model. For example, the director might type:

```
$CVPT/=A/S,7240,26,51,102 * TEAM A CHANGES SALARIES AT 7240
```

7. The general decision codes that can be used to make more than one type of specific decision require that a specific decision code by placed in the "a" space. The general and specific codes are summarized below:

	General Code and Meaning	Specific Code and Meaning
1.	$PU purchase land and/ or developments	None
2.	$CVPT change existing conditions on location-specific items	R - change rents P - change prices S - change business salaries M - change maintenance level of public and private developments E - change employment at a school or municipal service location

General Code and Meaning	Specific Code and Meaning
	C - award contracts to BG and BS by school or municipal service department.
	US - change or add utility service to a parcel of land
	Z - change zoning on a parcel
	PLND - add preempt land
	RPLND - replace preempt land
3. $OTHER change conditions for non-location-specific items	LO - grant a loan to another team
	BO - take a loan from the outside by a private team or a government department
	SP - invest in speculative stocks
	SELLSP - sell speculative stocks
	CN - invest in conservative stocks
	SELLCN - sell conservative stocks
	W - set the welfare payment per unemployed worker
	S - change salaries for SC, MS, BUS or RAIL department jurisdiction-wide
	M - change maintenance level of a highway type for an entire jurisdiction or of bus or rail equipment.
	P - change the price of utility service for a jurisdiction or fare for bus or rail
	PS - purchase bus or rail rolling stock
	SS - sell bus or rail rolling stock
	NOCI - play without a local CI
	YESCI - play with local CI
	INLO - move in a specified number of PL's via the migration routine
	INMID - move in a specified number of PM's via the migration routine.
	INHI - move in a specified number of PH's via the migration routine

	General Code and Meaning	Specific Code and Meaning
4.	$OUBLD have an outside construction firm build a private or public development	None
5.	$BUILD have a local construction firm build a private or public development	None
6.	$CASH transfer cash from one account to another	C - transfer of cash from other than the chairman's account CP - appropriate capital funds CR - appropriate current funds CURS - grant a current subsidy CAPS - grant a capital subsidy SB - grant a subsidy to an economic team
7.	$TIME allocate the leisure time for population units	H - for high income class M - for middle income class L - for low income class
8.	$BYCT boycott working, shopping, or using public transit	S - social boycott (by population units) E - economic boycott (by businesses)
9.	$VALUE change the dollar value of time for population units	H - for high income class M - for middle income class L - for low income class
10.	$TAXES change tax rates for various bases	L - assessed value of land D - assessed value of developments RI - income earned by residents of the jurisdiction EI - income earned by those employed within the jurisdiction

General Code and Meaning	Specific Code and Meaning
	RA - auto expenses of residents of the jurisdiction EA - auto expenses of those employed within the jurisdiction G - total value of PG sold by stores in that jurisdiction S - total value of PS sold by stores in that jurisdiction
11. $ASMNT make changes by the assessment department	UL - jurisdiction-wide assessment ratio for all undeveloped, non-farm land DL - jurisdiction-wide assessment ratio for land on all developed parcels FR - jurisdiction-wide assessment ratio for all farmland AD - development assessment ratio for a specific parcel AL - land assessment ratio for a specific parcel AF - assessment ratio for a specific farm parcel SD - assessed dollar value of development on a specific parcel SL - assessed dollar value of land on a specific parcel SF - assessed dollar value of land on a specific farm parcel
12. $REDIST change district boundaries for SC or MS	None
13. $FSA request federal-state aid by department	None

	General Code and Meaning	Specific Code and Meaning
14.	$ROUT change levels of service and routes for bus and rail operation	None
15.	$RAIL build rail lines and rail stations	None
16.	$WRBLD construction of water-related items	T - build water and sewage treatment plants S - locate water sampling stations P - locate municipal inflow and outflow points
17.	$WRPRC change water prices	None
18.	$ODDS A,B,or change existing conditions of non location-specific items	C - dam priority F - set farm fertilizer level R - set degree of flooding in a river basin
19.	$ENDS change existing conditions of location-specific items	L - set the operating level of a business R - set the percent recycling at a business W - set the water quality of a lake parcel P - set the miscellaneous pollution dumped on a parcel
20.	$HDNG Set the heading printed on output	None

8. Once the director and players have coded their decisions on the input forms, the decisions must be keypunched onto cards, one decision per card. The director should be aware of several mechanical procedures and card-punching shortcuts.

When decisions are processed by the computer program, the input card is printed and followed by messages regarding any errors in either the coding or the decision. The lack of any error message after a decision always means that the decision has been accepted. The fact that an error message prints after a decision usually means that the decision has been totally rejected and the error message prints the reason for rejection. In some cases an error message prints but the decision is accepted. Such is the case when there is an attempt to raise a residence's maintenance level more than 20 points above the lowest value which its quality index ever reached. The message indicates that the maintenance level input is too high and that the program has set the maintenance level at that residence to the highest allowed value.

The two most crucial items of information necessary for each decision are the dollar sign code, (for example, $CASH, $CVPT) which determines the type of decision, and the decision-maker (a government, economic or social sector team or the director). Note that each of these items is preceded by a special character ("$" or "=") and is followed by a slash ("/"). The information before a slash need be repeated only when it changes; i.e., when the decision type ($ code) and/or decision-maker are different from the last accepted code and/or team. A valid $code followed by a slash always replaces the previous $code; a valid "= decision-maker" followed by a slash always replaces the previous decision-maker. Thus, once an input decision has been accepted by the EDIT program, the subsequent inputs may require none of the primary information or only one of the two items.

For example, if economic decision-maker A were purchasing parcel 9418 for $120,000 from economic decision-maker C and parcel 9812 for $150,000 from economic decision-maker D, the inputs could be keypunched on the cards as follows:

Card 1: `$PU/-A/9418,120,C`

Card 2: `9812,150,D`

The next example illustrates inputting several economic decisions. B is changing a maintenance level, C is changing a rent, A is changing maintenance levels and a rent and purchasing two parcels as described above:

```
Card 1:  $CVPT/=B/M,10428,95

Card 2:  =C/R,8222,145

Card 3:  =A/M,10832,97

Card 4:  M,9634,92

Card 5:  R,7632,160

Card 6:  $PU/9418,120,C

Card 7:  9812, 150,D
```

Each decision should be entered on a separate card to simply present the decisions as well as determine to which error statements the EDIT program refers. Of course, each distinct decision with its complete code may be put on a separate card.

As is noted in the Players' Manual, there are some shortcuts especially applicable to zoning and district boundary changes, where the listing of parcels is valid.

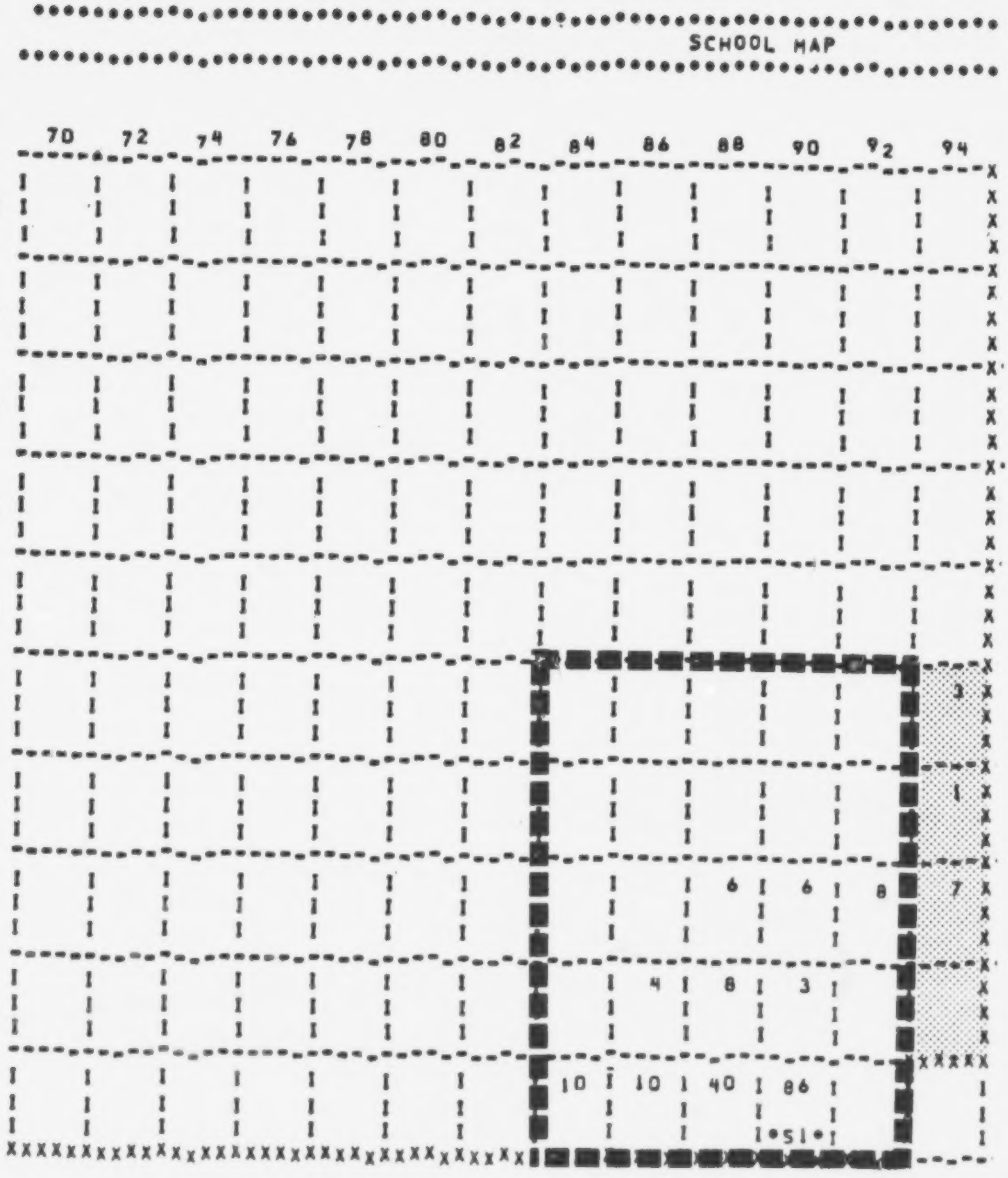
- Any information within parentheses is treated in the same way; e.g., if a player is changing the maintenance level of several developments to 90, he could type (9228, 9830, 7212, 8814) where location is requested. This saves typing an entirely separate input for each location.

- If all of the parcels in a rectangular area are to be treated the same way, the parcels at opposite corners of the rectangle can be designated with a ">" between them where location is requested. For example, the School Department may want to make the outlined area in the figure on the following page a school district for the school at 9030. The location could be specified as (8422>9230).

  If the line of parcels from 9422 through 9428 were also to be part of the district, the entire input would be:

  ```
  $REDIST/=SC1/9030,(8422>9230,9422>9428)
  ```

SCHOOL MAP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24
26
28
30
3
1
6
6
8
7
4
8
3
10
10
40
86
•51•

In summary, when all information in a decision is to be identical for more than one parcel, the locations of the parcels can be "listed" in the coded decision. A list is enclosed in parentheses and parcel locations in the list are separated by commas. A list can contain a "block". A block represents a rectangular grouping of parcels on the board and is coded as the location of the upper left parcel and the location of the lower right parcel, separated by a greater than (>) sign. A list can contain up to 65 parcel locations, whether parcels are listed separately or in a block.

Parcel lists are allowed by the following input codes:

$PU
$BUILD - $OUBLD (construction site)
$CVPT
$TIME
$RAIL
$ASMNT
$FSA
$REDIST

5.6 Summary of Player & Director Decisions

1. Economic Decision-Makers

- buy and sell land
- set rents
- set prices
- set salaries
- set maintenance levels
- lend money
- borrow money
- buy and sell conservative stocks
- buy and sell speculative stocks
- build and demolish three types of residences, twelve types of basic industries, and four types of commercial establishments
- contract with construction industries
- transfer money to other economic and social and government decision-makers
- boycott commercial establishments
- construct chlorination, primary, secondary and tertiary effluent treatment facilities at basic industries
- change the operating level of a business (without demolishing the building)
- set the amount of water which is recycled at basic industries
- construct residences which use ground water
- operate farms

2. Social Decision-Makers

- allocate time to extra work, education, politics and recreation
- boycott work locations, commercial establishments, and modes of travel
- vote for elected officials
- set the dollar value of time travelling to work
- transfer money to other social, economic and government decision-makers

3. Government Decision-Makers

- grant appropriations
- grant subsidies
- transfer money to other government and social and economic decision-makers
- set welfare payments
- set tax rates
- float bonds

- assess land and buildings
- buy and sell land
- set the number of job openings in government
- set the maintenance level of government facilities
- set government service districts
- request Federal-State aid
- set the salaries offered government workers
- build and demolish schools
- build and demolish municipal service plants
- contract with construction industries
- grant contracts with local goods and services establishments for government purchases
- set the amount of public adult education offered by the government
- construct and demolish roads
- construct and demolish terminals
- zone land
- build and demolish public institutional land uses
- provide parkland
- install utility service
- set prices for utility service
- construct and demolish utility plants
- locate bus routes
- buy and sell buses
- set bus and rail fares
- build rail lines
- build rail stations
- buy and sell rail rolling stock
- locate rapid rail routes
- set the amount of service on bus and rail routes
- set prices for private use of publicly-provided water
- construct and demolish primary, secondary, and tertiary sewage treatment plants
- construct and demolish water intake treatment plants
- locate municipal water intake points
- locate municipal sewage outflow points
- locate water sampling stations
- set dam priorities
- change a business's operating level (without demolishing the building)
- construct and demolish bridges across rivers

4. Model Director Options

- make any decisions allowed to players
- specify the number of in-migrants for any social class

- specify whether local construction industries will be represented in the model
- select the data base which will be used in a run of the model
- set the water quality of lake parcels
- set the amount of miscellaneous pollution dumped on a parcel
- set the flood severity in a river basin

5.7 Samples of Director Inputs

The director has several decision options available. The purpose of the options is to provide the operator with as much flexibility as possible in the game situation. Those options are described below with examples and summarized at the end of this section. The instructor may employ any combination of options.

One. Transfer of Cash To and From the Outside System

In order to correct financial imbalance or to simulate federal grants, etc., the director can transfer cash to or from an economic or social decision-maker or the capital or current account of the Chairman or a department. He uses the regular $CASH routine but his decision-maker identification is 0U (for Outside System) if he is the giver. If the Outside is the receiver, the decision-maker is the team from which money is being taken.

The following is the correct format:

$CASH/= dm/C, a, b, c, d, e, f

where dm is the giver (0U or decision-maker)
a is the receiver (0U or decision-maker)
b is the number of dollars (with no commas or dollar signs)

c refers to the account from which the money is being transferred (PVT for Outside or economic decision-maker; H, M, or L to designate a class if a social team; CUR, a department's current account; CAP, a department's capital account)

d refers to the account into which the money is being transferred (PVT for Outside or economic decision-maker; H, M, or L to designate a class if a social team; CUR, a department's current account; CAP, a department's capital account)

e is the residence location if the transfer is from a social team, and zero if the transfer is not from a social team

f is the residence location if the transfer is to a social team, and zero if the transfer is not to a social team

For example, if the director wants to transfer one million dollars to the Jurisdiction 1 School Department's capital account, he would type:

```
$CASH/=OU/C,SC1,1000000,PVT,CAP
```

The director can also use a similar format when transferring money from a decision-maker's account to the outside system:

```
$CASH/=SC1/C,OU,1000000,CAP,PVT
```

Such action may be taken to induce serious governmental debts or an economic recession for example.

Two. Float Capital Bonds

Since capital bonds are subject to referenda, they should be floated by the director upon approval by the social sector. The input format for capital bonds is: $OTHER/=department and jurisdiction receiving/BO, amount (in $10,000's),25. For example, if a capital bond of 25 million dollars is approved for the Jurisdiction 2 Municipal Services Department, the format would be:

```
$OTHER/=MS2/BO,2500,25
```

All capital bonds have a term of 25 years and the interest rate is determined by the computer.

<u>Three</u>. Land Bids

If the director wishes, he can control the bids on all parcels of land owned by the computer. He can determine which parcels of land are up for auction and which bidder will get each parcel of land through game administration. In order to guarantee that a player receives a parcel of land, the director uses the following input format:

`$PU/=team bidding/location,price (in $1000's)`

```
OU,percent of parcel (0, if all),1
```

For example, if economic decision-maker B has bid $150,000 on parcel 7224 and the director wants to guarantee that B receives it, he would type:

```
$PU/=B/7224,150,OU,0,1
```

The "1" in column "e" tells the computer not to handle the bid in the ordinary manner (as explained in the Players' Manual) but to guarantee it to the decision-maker who is initiating the bid and has input valid data in the first three or four columns.

<u>Four</u>. Create or Remove Public Land (Preempt Land Use).

The director may use the Preempt category to represent any type or mixture of non-usable land that he wants. For example, he can suggest that preempt land represents institutional land holdings (such as federal land, military bases, large land easements, cemeteries, golf courses, country clubs, and non-usable public land) or land that is not usable because of topographical constraints (water bodies, excessive slopes, swamp or marshland, or rock outcroppings). The director can add an amount of preempted land to the local government (representing perhaps a federal land grant) or to the economic sector at a price (representing perhaps the cost of an expensive land fill operation on a piece of swamp property to make it usable for development).

Since the Preempt Land Map will not distinguish the type of preempt category for any particular parcel, it is the responsibility of the game director to record which land is in the various types of uses (i.e., water, airport, federal reservation, etc.). The game operator's ability to start play with any amount of preempt land allows him great influence in the play of the model if he wants to exercise it.

The input format is:

`$CVPT/=0U/PLND,location,percent of parcel to be added to undevelopable.`

`$CVPT/=0U/RPLND,location,percent of parcel to be taken out of undevelopable.`

For example, the director may decide that he will represent the land taken away from potential local development by creating an airport near the edge of the city, at 8230. He will put 60% of the parcel into preempt use and give the owner, B, $1.5 million for the land.

```
$CVPT/=ØU/PLND,8230,60

$CASH/=ØU/C,B,1500000,PVT,PVT
```

If, on the other hand, the director desires to make some preempt land available for purchase and/or development he may make a RPLND (remove preempt land) decision. In this case, the land goes into the holdings of whichever private land owner (an economic team or the outside system) possesses other privately-owned land on that particular parcel. If all land on the parcel was previously preempt and publicly owned or just preempt, the outside system would become the new owner. The following three cases will illustrate the usage of RPLND.

Case One. Parcel 10020 was a military reservation, entirely in the preempt category. The input:

```
$CVPT/=ØU/RPLND,10220,40
```

makes forty percent of the parcel available for purchase by any government or economic decision-maker by means of a land bid to the outside system.

Case Two. Forty percent of the same parcel is to be bought outright by economic decision-maker B and twenty percent by UT2. Assume that the director has placed the cost at $1,000,000 for 100 percent of the parcel (although not all will be available). The transactions would be completed via the following inputs (there are alternative methods which would also work):

```
$CVPT/=ØU/RPLND,10020,60
$PU/=B/10020,600,ØU,0,1
$PU/=UT2/10020,200,B,20
```

Case Three. Economic team C owns twenty percent of parcel 7630. The remainder (eighty percent) has been preempt but the director decides to allow team C to purchase the remainder for $650,000. The required inputs:

```
$CVPT/=ØU/RPLND,7630,80
$CASH/=C/C,650000,ØU,PVT,PVT
```

Five. Decide to Use a Construction Industry.

If the director decides to incorporate a Construction Industry in the game, players may contract for construction with a local CI, or have an outside firm perform the work at 130% of the typical cost.* If local CI's are allowed in the game, a new development begins operation in the round after the decision to build is accepted by the computer. The director may want to simplify construction procedures by having all construction performed by outside firms at 100% of typical cost. In this case, as there are no player-operated CI's on the board, a new development begins operation immediately after the construction decision is submitted and accepted by the computer.

By operating local construction industries the system retains much more revenue in terms of CI income and its subsequent distribution to profits, salaries, goods and services establishments, and taxes, and moreover, boosts employment. On the other hand, players may desire to avoid contending with the relative complexity of this particular economic activity. Furthermore, the local CI situation (YESCI) requires that construction projects take one more round to complete than the NOCI situation, in which completed projects appear the round immediately following the contract input.

The director may want to begin the game without a CI and allow it to be used after the players acquire some familiarity with the model. Or, if the game is to be run with a group for only a few rounds, the director may want to enable players to see the results of their construction decisions sooner than they would if CI were used. In this case, players should use the $OUBLD input for all construction and demolition.

The computer programs operate as though CI's are being used unless the director specifies otherwise. Either decision, once made, is in effect until the director changes it.

The input code to prohibit CI is:

`$OTHER/=0U/N0CI`

---

*The actual percent of typical cost charged for construction by an outside firm is a loaded value and is not necessarily 130%.

This decision will not take effect if there is a CI on the board. The director must demolish all CI's with the regular demolition input format, and then input the decision to prohibit CI.

If the director wishes to use a data base which already has CI's and/or has not been specified NØCI, he perform the necessary demolitions and/or NØCI specifications before running Round 1 output.

After NØCI has been accepted by the computer, the computer will accept no attempts to build CI's. All construction costs will be equal to the typical costs. New development will begin operation in the same round that the construction decision is input.

The input to allow local construction industries is:

```
$OTHER/=OU/YESCI
```

For example, the director may choose to show how a natural disaster affects the city. Subsequently, he announces through the media, the destruction caused by the disaster and puts in the actual demolition decisions as though he were the owner of the developments and/or transportation links. Suppose the disaster demolished a section of highway and a level one Business Goods bordering the highway. Assume that the Business Goods owned by economic decision-maker B, is located at 9840, and the highway is an HY2 at 9839 and is in jurisdiction one. Then the required input decisions are:

```
$OUBLD/=B/9840,BG,1,0
```

```
$OUBLD/=HY1/9839,HY,2,0
```

To compensate for the expenditures incurred by these demolitions the director can transfer cash into team B's and the Highway Department's account.

To emphasize the director may in fact make any player decision, but he should use caution in exercising this option. If the reasons behind his decisions seem unclear and/or illegitimate to the players, they may revolt and institute illegitimate decisions of their own. In order to prevent such player reactions, the director may have to set up a "judiciary" which reviews all decisions to assure that the legal teams made them. Of course, the director could assume responsibility for the review.

Six. Vary the Number of In-Migrants

The director may specify the number of in-migrants, including those due to natural population growth. This decision applies for one round only. For any population class where the director has not specified the number of in-migrants, the program will use the in-migration portion to determine the number of in-migrants.

The input format is:

$OTHER/=0U/class (INHI,INMID, or INLO), number of Pl's to be in-migrants.

For example, during the fourth round the director wishes to force a severe low-income unemployment problem and a shortage of high-income workers. He decides that he will move in 60 PL's and no PH's. He submits the following cards.

```
$OTHER/=0U/INLO,60
$OTHER/=OU/INHI,0
```

The migration routine determines the in-migration for all classes not specified (in this case, middle). The next round, the director does not wish to set the number of in-migrants for any class in any jurisdiction, so he submits no-in-migration inputs.

5.8 General Input Information

Common Procedural Errors (inputs that do not conform to the required input format)

1 Mispunch of the Input Code:

Correct	Mispunched
$PU	$PV
$CVPT	$CUPT
H1 (PH in jurisdiction 1)	HI
M1 (PM is jurisdiction 1)	MI
L1 (PL in jurisdiction 1)	LI
HI (heavy industry)	H1
LI (light industry)	L1

2. Omission of "=" before decision-maker.
3. Omission of slashes (/) or commas (,).
4. Placement of information in the wrong columns.
5. Omission of jurisdiction number for departments and social classes.
6. Incorrect scaling of numbers.
7. Use of dollar signs ($) and commas (,) on dollar amounts and large numbers.

Common Substantive Errors (inputs that do not conform to the data base)

1. Developments specified at incorrect "old level".
2. Incorrect parcel location
3. Inadequate cash
4. Inadequate capacity of utility service
5. Conflicts with zoning
6. Incorrect owner is identified
7. Inadequate land available for construction

Appendix I. THE OUTSIDE SYSTEM

The Outside System represents all exogenous influences on the local system. It is the source of all money and people which enter the local system and is the destination of all money and people which leave the local system.

Together, the game director and the computer represent the Outside System. The major components of the Outside System are:

A. Business Cycle -- affects prices paid for basic industry output, the return on investments in stocks, and the interest rate on loans and bonds involving the Outside System.

B. Federal-State Aid -- affects the amount and type of aid that local government departments may receive.

C. Federal-State Taxes -- affects the taxes that leave the local system.

D. Migration -- affects the movement of people (Pl's) into and from the local system.

E. Auction and Bids -- affects the chances of teams or departments acquiring land that is presently owned by Outside interests.

F. Suppliers of Goods and Services -- affects the price at which all goods and services may be purchased from the Outside.

The different components of the Outside System are described in the order listed above.

A. Business Cycle

Basic Industry Prices

The business cycle follows the pattern shown in Figure I-1. Note that the variation in HI average prices is greater than that for LI which is, in turn, higher than that for NS. To calculate the price received per unit of output for any basic industry in the local system, multiply the normal price per unit for that type of basic industry times the business cycle index for that basic industry. For example, if a TA had a normal price per unit of output of $100,000, then its price in round 3 would be 1.04 X $100,000, or $104,000.

FIGURE I-1

BUSINESS CYCLE

Edits Before Round:	Output For Round:	Outside Loan Mean Interest Rate (%)*	Basic Industry Ratio of Price Per Unit Output To Normal Price			Percent Return on Investments (Mean)	
			HI	LI	NS	Conservative	Speculative
1	24	5.1	1.05	1.04	1.03	6.1	8.9
2	1	5.2	1.08	1.07	1.05	6.3	9.2
3	2	5.7	1.07	1.07	1.06	6.2	4.7
4	3	5.3	1.03	1.04	1.03	6.1	8.7
5	4	5.1	.99	1.00	1.01	5.9	4.0
6	5	4.8	.93	.97	.98	5.4	-1.5
7	6	5.0	.95	.98	1.00	6.0	6.3
8	7	5.2	1.00	1.02	1.02	6.1	8.5
9	8	5.5	1.02	1.03	1.04	6.3	7.0
10	9	5.9	1.06	1.04	1.05	6.7	1.0
11	10	6.2	1.07	1.04	1.04	6.5	8.5
12	11	6.1	1.02	1.01	1.02	6.0	3.9
13	12	5.4	.98	.99	.99	5.7	-1.0
14	13	5.0	.94	.96	.97	5.8	5.9
15	14	4.7	.90	.93	.95	5.1	7.0
16	15	5.1	.97	.98	.99	6.0	9.3
17	16	5.4	1.01	1.02	1.01	6.3	6.5
18	17	5.9	1.07	1.07	1.05	6.7	2.1
19	18	5.8	1.12	1.10	1.05	6.4	4.9
20	19	6.0	1.10	1.08	1.04	6.5	8.3
21	20	5.3	1.02	1.05	1.01	7.0	7.5
22	21	4.7	.97	1.00	1.02	6.5	9.5
23	22	4.3	.95	.97	.99	5.4	7.3
24	23	5.1	1.00	.99	1.01	6.0	6.4

*The mean interest rate on government bonds is 2 percent below the mean outside loan rate in a given round.

Return on Conservative and Speculative Investments

The average return on conservative and speculative investments is the same for each team in a given round, but a standard value is applied to that average for each team. The standard value applied is derived from a table similar to, but with wider diversity than, the table shown above. For example, in Round 2 one owner of conservative stocks may have the value of his investments increased by 6.3 percent (the average) but another owner may have his increased by 8.0 percent.

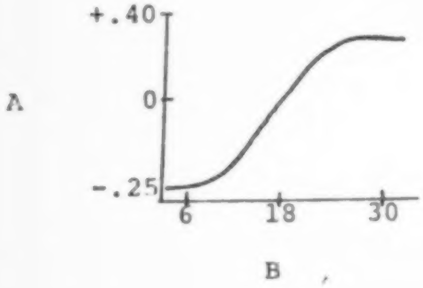
B. Federal State Aid

Two government departments (SC and MS) receive federal-state aid automatically for certain current programs. The School Department receives $225 per student enrolled in public schools and the MS Department receives two federal-state aid dollars for every local dollar spent on welfare, up to the limit that federal-state aid may not exceed $35 times the local jurisdiction population. These departments need not apply for this aid, as they receive it automatically.

Two government departments (SC and HY) may request and receive federal-state aid for capital projects. These departments must match the federal-state aid received with specified amounts of their own funds. Each aid request for a capital project has a specified probability of being funded in a given round. These conditions are summarized below:

Dept.	Project	Maximum Number of Requests per Jurisdiction	Matching Ratio (F-S to Local)	Probability
SC	Build or Upgrade Schools	3	1:1	.60 for first request .40 for second request .30 for third request[a]
HY	Build HY1	5 road segments	1:9	.80
	Build HY2		1:1	.50
	Build HY3		2:1	.30

The probability increases as the jurisdiction public school enrollment averages more than 18,000 per school, and decreases as the average enrollment is less than 18,000.



A = change in probability
B = average number of students (in thousands) served per level of school in the jurisdiction.

Each segment in a road is judged separately when Federal-State aid is requested.

A department that receives federal-state aid may spend that aid in the following round or any round thereafter. In other words, the aid is granted and the department can spend the aid whenever it pleases. The aid must be spent on the specific construction project for which it was requested. For example, if a proposed SC1 at 10842 received the federal-state aid, the aid could only be used for that specific proposed school.

The game director may at his own initiative or in response to player requests, develop any new federal-state aid program by using his $CASH prorogatives, i.e., he can input cash to any economic or government account. This option has been used on many occasions to simulate such federal programs as Model Cities, Urban Renewal, Low Cost Housing Support, Mass Transit Demonstration Grants, Small Business Administration, Labor Department Training Grants, etc.

C. Federal-State Taxes

Federal

Federal personal and business income taxes are paid by local system population units and businesses. The federal income tax rates are:

Loan and Bond Interest Rates

The basic outside loan rate is also realted to the national business cycle. The interest rate shown in Figure OS-1 is used as an average when the actual interest rate on each loan is calculated.

In order to determine the interest rate on a specific loan from the Outside, the computer generates a random number between 1 and 1024. Depending on what the random number is, a percent is added to or subtracted from the average interest rate for the round.

Random Number	Value to be Added to Mean
1	- .5
2 - 11	- .4
12 - 56	- .3
57 - 176	- .2
177 - 386	- .1
387 - 638	0
639 - 848	+ .1
849 - 968	+ .2
969 - 1013	+ .3
1014 - 1023	+ .4
1024	+ .5

The interest rate on government bonds is determined in the same fashion, except that the average is 2% less than the average outside loan interest rate and the values associated with the random numbers are half of the loan values.

Because the round number is incremented during output, all interest rates calculated during the EDIT phase use a different average from those calculated during output. This difference is apparent only for the interest rates on government bonds. For example, capital bonds which are floated as inputs to round 3 have an average interest rate of 3.7%. A current bond floated during the simulation executed to produce Round 3 to cover a department deficit would have an average interest rate of 3.3%.

Taxpayer	Rate
PH	8% of total full-time and part-time employment income
PM	4% of total full-time and part-time employment income
PL	1% of total full-time and part-time employment income

Businesses

Of first $25,000 net income	22%
Of remainder of net income over $25,000	48%

These federal tax rates do not change during the play.

State

State sales taxes are paid by all private purchasers of goods and services whether the selling establishment is in the local or Outside System. The state sales tax is fixed at 3% of total expenditures for goods and services.

D. Migration

The game director has the option of directly affecting migration results by specifying the number of in-migrants by class. With respect to the Outside System, however, it is important to recognize that the people moving in and out of the local system also operate within a larger national system. That is, to the extent that the local system attracts net migrants from the Outside it will grow at a faster rate than natural population growth alone would allow. Conversely, if local conditions are such that there is a net out-migration from the local system to the Outside System, then the local population will stabilize or decrease depending upon the extent of the out-migration.

E. Auction and Bids

Local system decision-makers are dealing with the Outside System any time they make a bid to purchase a piece of land that is not owned by someone in the local system. The value of the land owned by the Outside System is calculated by using a formula that takes into account the location of the land with respect to terminals, residences, employment and road access. The formula also takes into account the zoning of the parcel and whether or not it has utility services. More specifically, the value of a computer-owned parcel is calculated so that:

Each round, six outside-owned parcels are selected randomly to be auctioned to the highest bidder. The value of outside-owned land is determined each round from:

PRICE = the full market value of an outside-owned parcel.

VALUE = the average value for 100% of privately owned and undeveloped parcels (a minimum of $64,000)

POINTS= the sum of the parcel's points as described below

$$\text{PRICE} = \frac{\text{VALUE X POINTS}}{50} + \frac{\text{VALUE}}{15}$$

For each parcel, points are calculated on the following scale:

Distance to nearest terminal (miles):

Distance	0	1	2	3	4	5	6+
Points	45	40	35	30	25	20	5

Distance to nearest residence (miles):

Distance	0	1	2	3	4	5	6+
Points	18	15	12	9	6	3	0

Distance to nearest employment (miles):

Distance	0	1	2	3	4	5+
Points	25	20	15	10	5	0

Utilities: 20 points if present; 0 if not

Zoning Classification:

Zoning Code	00	10's	20's	30's	40	41	42	43	50
	35	25	20	20	15	3	6	12	0

Road Access:

For each road which enters an intersection at a corner of the parcel but does not border the parcel (a maximum of 8 roads).

Road Level	1	2	3
Points	1	2	3

The probability of a bid being accepted depends upon the amount of the bid in relation to the value of the land as calculated by the land value formula, competing bids, and the type of bid (an auctioned parcel or an unsolicited bid).

F. Suppliers of Goods and Services

Some goods and services are purchased only from the outside:

a. BS and BS requirements (regular plus maintenance)
b. Bus and rail rolling stock (purchase and maintenance)
c. Highway maintenance
d. Utility installation on parcels (and operating costs)
e. All transportation and construction expenses

The purchase of other goods and services are made either from local firms or from the outside depending upon the capacity, prices and location of local establishments; boycotts on the part of the consumers; transportation access; and contractual shopping agreements.

Since Outside System prices are fixed (higher than typical inside prices), the Outside firms set an effective upper limit on the price that can be charged by local monopoly or colluding firms. Whereas all local firms have finite capacities to sell goods and services, the Outside System has an infinite capacity in so far as the demands of the local system are concerned.

Outside System Master Table

Business Cycle Factors

Rate of Return on Stocks	Normal	Range
Speculative	6.4	-1 to 10%
Conservative	6.0	5 to 7%
Price Relatives for		
Heavy Industries	1.00	.90 to 1.12
Light Industries	1.00	.93 to 1.10
National Services	1.00	.95 to 1.06
National Interest Rates	5.1	4.3% to 6.2%
National Bond Rates	3.1	2.3% to 4.2%
Interest on Savings	2.5	None

Prices

Price of:

Water (Per MG)	When quality level 9	$700
	For residences with private utilities	$500
Septic Tanks (per RA1)		
At Construction		$75,000
Annual Operation		(local jurisdiction prices)

	Raywid City	Two City
BG and BS	$150.000	$130,000
PG and PS	15,000	13,000

Federal-State Relationships

Federal-State Taxes

Business and Personal Income

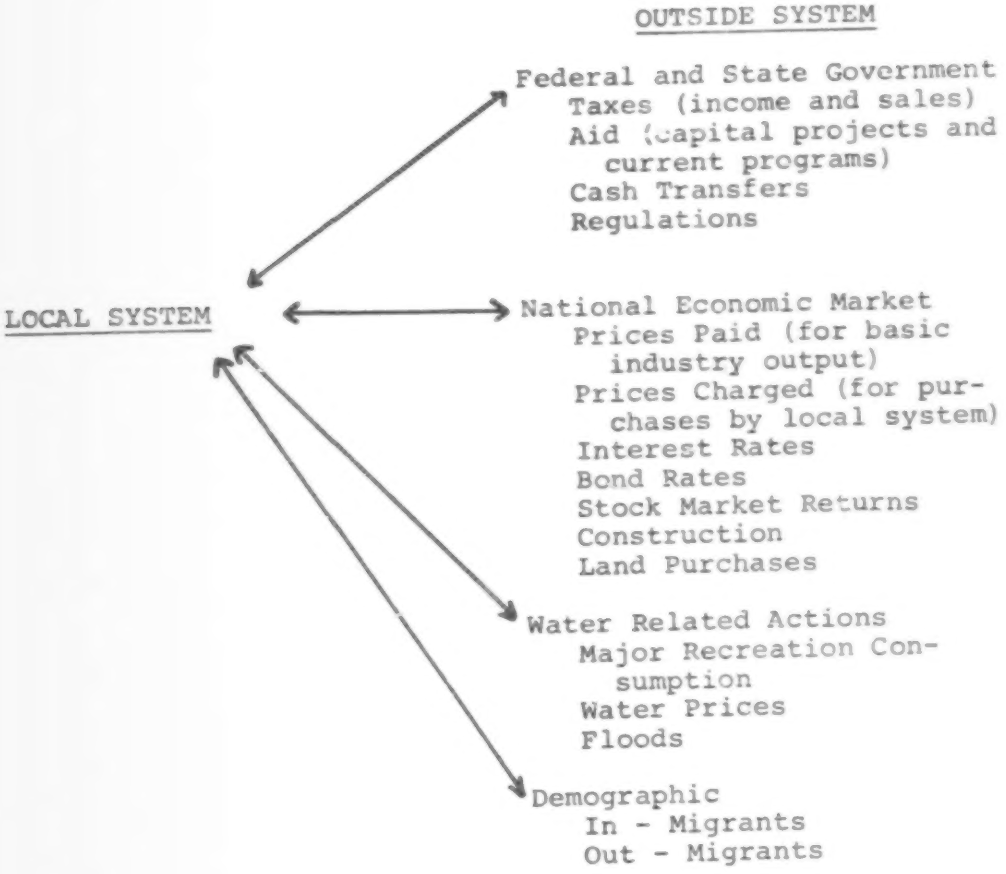
State - 5% of net income.
Federal - 22% of first $25,000 of net income before taxes and of 48% on the rest of net income and after State income taxes.

Sales Tax (State) - 3% of the total purchases of goods and services.

OPERATION OF FEDERAL-STATE AID

Department	Basis			Limit on Number of Requests per Jurisdiction	Probability of Receipt
School					
Current Aid	$225/student			N.A.	Automatic (no request needed)
Capital Aid	Match dollar for dollar			3	60% (1st request) 40% (2nd request) 30% (3rd request)
Highways	Type of Road	Matching Federal	Matching Local		
Capital Aid	I	$1	$9	5 road segments	80%
	II	$1	$1		50%
	III	$2	$1		30%
Municipal Services					
Current Aid	Two Federal-State dollars for each local dollar up to maximum total paid of $35 per resident of the jurisdiction			N.A.	Automatic

Major Outside System Interactions with the Local System



OUTSIDE SYSTEM

LOCAL SYSTEM

Federal and State Government
  - Taxes (income and sales)
  - Aid (capital projects and current programs)
  - Cash Transfers
  - Regulations

National Economic Market
  - Prices Paid (for basic industry output)
  - Prices Charged (for purchases by local system)
  - Interest Rates
  - Bond Rates
  - Stock Market Returns
  - Construction
  - Land Purchases

Water Related Actions
  - Major Recreation Consumption
  - Water Prices
  - Floods

Demographic
  - In - Migrants
  - Out - Migrants

II. EXPLANATION OF THE WATER COMPONENT

The water component can be looked at as a module that is plugged into the other major modules of the regional model, This module could be changed without changing other parts of the model (and vice versa) as long as the links among the modules were modified accordingly.

A. Water Quality Ratings

In order to summarize and simplify the concept of "water quality" in the model, an index of water quality has been created. The value of this water quality index at any location in the system is determined by the concentrations of the seven pollutant categories. FigureII -1 lists the nine water quality ratings and the seven types of pollutants dealt with by the model. Note that the higher the quality rating, the lower the quality of the water.

The average quality rating of water on a parcel is calculated each round by taking the highest index caused by any of the pollutants. Figure II-2 shows the water quality level generated by concentrations of each of the pollutants. An explanation of the table is also included in the figure.

Each parcel of land that contains surface water (lakes or rivers) has a water quality index calculated for it. The water quality rating for a parcel affects the treatment cost paid by users of that water. The quality rating also affects the pollution index, the rate of depreciation for some developments, the usability of the water (level 9 water is not usable), and major recreation activity. The Water Quality Map (Figure II-3) shows the water quality rating for each parcel of land that has surface water, the direction of flow of rivers, the location of economic activities (including farms), and the individual pollutant responsible for the water quality rating.

B. Water Use and Sources of Water

All private economic activities require water as part of their normal operation. Figure II-4 shows the consumption of water in millions of gallons per day (MGD) for each of these activities. Some of the manufacturing activities are surface water users, and they must intake water from the parcels on which they are located. All of the other activities use municipally supplied water (except those few residences which have private water supplies).

Figure II-1

Water Quality Rating	Description
1	Drinkable - best quality water
2	Drinkable - with minor treatment
3	Swimming - direct body contact possible
4	Boating and Fishing - indirect body contact possible
5	Fair esthetic value
6	Poor esthetic value - treatable at moderate cost
7	No esthetic value - treatable at high cost
8	Negative esthetic value - treatable at very high cost
9	Unusable water

Pollutants	Description
BOD	Biochemical Oxygen Demand
Chlorides	Chlorides are employed as an indicator of persistent pollutants.
Nutrients	Phosphate, nitrite, nitrogen, and phosphorous.
Coliform Bacteria	Indication of the potential health hazard of a given body of water.
Temperature	The temperature deviation from the normal temperature of the surface water.
Oil and Floating Solids	Any oil and all floating solids such as refuse, garbage, cans, boards, and tires.
High-Level Wastes	Highly toxic, non-degradable substances.

Figure II-2

Definition of the Nine Comprehensive Water Quality Levels

Pollutant Types	Water Quality Levels 1	2	3	4	5	6	7	8	9
BOD (LBS/MG)	10	20	30	40	60	100	150	300	> 300
Chlorides (LBS/MG)	5	10	15	20	30	40	60	80	> 80
Nutrients (LBS/MG)	25	50	100	200	400	800	1600	3200	> 3200
Coliform Bacteria (parts per MG)	2	6	12	20	40	70	120	160	> 160
Temperature	0	0	1	2	4	7	10	14	> 14
Oil & Floating Solids	0	0	0	0	0	> 0	> 0	> 0	> 0
High Level Wastes	0	0	0	0	0	0	0	> 0	> 0

Explanation of the Table

In order to determine the water quality level or index of given amounts of water, take the concentrations of each of the seven pollutant categories and calculate the water quality level based upon each pollutant separately. For example, a BOD concentration of 25 LBS/MG would yield an index of 3, coliform bacteria of 169 parts per MG would yield an index of 9, and the presence of oil and floating solids would allow the water quality to be no better than 6. The worst (highest) water quality index that was calculated using the pollutant types separately, is assigned to the given amount of water. If the water on parcel x had the three pollutants described above, it would be assigned water quality index of 9.

Looked at another way, water quality level 4 is attained when a body of water has concentrations of BOD that exceed 30 but fall below 41, coliform bacteria concentrations above 12 but below 21, etc.

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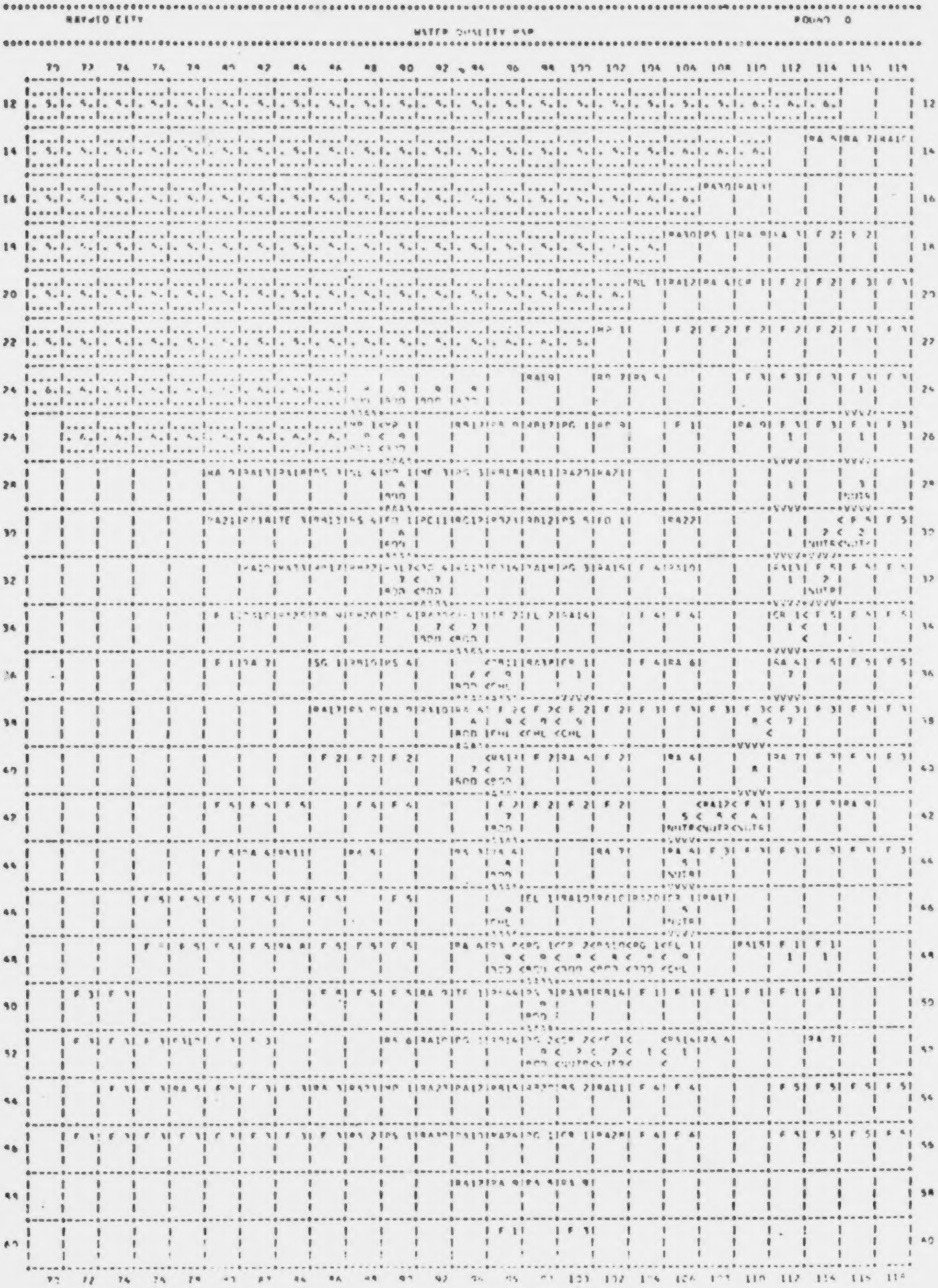
Figure II-3


WATER QUALITY MAP
ROUND 0
70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100 102 104 106 108 110 112 114 116 118
12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60

PARCELS

TOP ROW: ECONOMIC ACTIVITY TYPE AND OPERATING LEVEL
FARM TYPE IF FARM ON PARCEL
MIDDLE ROW: SURFACE WATER QUALITY RATING
BOTTOM ROW: WORST POLLUTANT

.... LAKE PARCELS

PARCEL EDGES

>AV< DIRECTION OF FLOW

---- NO WATER FLOWING BETWEEN PARCELS

Figure II-4

Water Requirements For
Private Economic Activities
(S=Surface Water User)

Manufacturing		MGD
FL	Furniture and Lumber (S)	61
SB	Stone, Clay, and Glass	10
MP	Primary Metals (S)	225
MF	Fabricated Metals	9
NL	Nonelectrical Machinery	12
EL	Electrical Machinery	5
TE	Transportation Equipment	8
FO	Food (S)	49
TA	Textiles and Apparel (S)	17
PA	Paper (S)	333
CR	Chemical and Rubber (S)	31
Commercial		
NS	National Services	.18
BG	Business Goods	.13
BS	Business Services	.17
PG	Personal Goods	.23
PS	Personal Services	.18
Residential		
HA	High Income and Single Family	.08
HB	Garden Apartments (PH)	.07
HC	Highrise Apartments (PM)	.06
MA	Single Family (PM)	.07
MB	Garden Apartments (PM)	.05
MC	Highrise Apartments (PM)	.03
LA	Single Family (PL)	.03
LB	Garden Apartments (PL)	.03
LC	Highrise Apartments (PL)	.02

Surface water users pay for the cost of treating the water they take from the local water system. Municipal water users pay the price charged by the Utility Department. The Utility Department constructs intake facitities and treats the water if necessary to supply the water needs of each utility district.

There are four possible sources of water, although no single type of user has an option to use all of these.

Water Users

Sources	Industries Using Surface Water	Water Department	Residences	Commercial Activities & Industries Using Municipal Water
Surface Water	x	x		
Municipal Water			x	x
Outside Water	x	x	x	x
Ground Water			x	

Residents use ground water if private utilities are installed. Residences are the only activities that may satisfy their water needs through the use of wells.

Surface Water Industries and the Water Department use water from the outside system if there is an inadequate amount of water on the parcel from which they withdraw or if the water quality level is 9. Both residences and businesses using municipal water will use outside water if the water department serving them has inadequate supply.

Three types of surface water are represented in the model: rivers (flowing bodies of water), small lakes and large lakes. Large lakes are full parcels or combinations of full parcels of water. Large lakes have an unlimited volume of water and a loaded water quality level that does not change during the course of a run of the model.

Small lakes are fractions of a parcel of land. They are defined as having a specified water volume and percent of parcel consumed. Their water quality level is calculated in the same manner as for rivers.

Rivers are loaded as being on particular parcels, having specific volumes, flowing at specific rates, and emptying into designated adjacent parcels. Rivers may or may not consume a significant (one percent or more) portion of land or parcel. In other words, the land area consumed by a river may not be large enough to take into account.

All volumes are expressed in millions of gallons per day (MGD), and rates of flow are expressed in parcels of land traversed in a day by a particle of water in the river.

The following table summarizes the types of water and their characteristics:

Types of Surface Water	Volume	Water Quality Level	Rate of Flow
Rivers	Specified	Calculated	Specified
Small Lakes	Specified	Calculated	Not Applicable
Large Lakes	Unlimited	Specified	Not Applicable

C. Pollutants Generated

All economic activities return their used water to the local water system. Surface water users may opt to treat all or part of the water they return to the system with one of four types of treatment. The other economic activities return their water to the water system via the outflow point of the utility district in which they reside.

The specific amounts of pollution generated per level one activity and per million gallons of water for each of the types of economic activities is shown in Figure II -5 Note that the pollution generated by residences is a function of both the type of housing and the income class living there.

D. Pollution Monitoring

The Water Office of the Utility Department may find out the detailed components of the water quality rating for any water parcel (the ambient water quality) or for any point source of water outflow (from surface water industries or from the municipal outflow point). Figure II -6 shows examples of the ambient and point source sampling station reports. Note that the point source information includes the economic owner of the economic activity, the type of economic activity, and the type and level of treatment facilities, if any.

E. Pollution Treatment

Surface water using industries and the municipal water offices may treat their water outflow to reduce its concentrations of pollutants. Figure II -7 shows the effectiveness of the four types of treatment in removing the seven types of pollutants. For example, chlorination is effective against only coliform while tertiary treatment is effective against all of the pollutants.

Figure II-5

POLLUTION GENERATED BY ECONOMIC ACTIVITIES

	BOD (LBS/MG)	Chlorides (LBS/MG)	Nutrients (LBS/MG)	Coliform (PARTS/MG)	Temperature	Oil and Solids	High Level Wastes
Manufacturing							
FL	600	100	1000	20	9	1	0
SB	500	100	1000	10	0	0	0
MP	1000	170	500	20	6	1	0
MF	500	150	700	30	0	1	0
NL	400	150	100	20	0	0	0
EL	800	200	200	20	0	0	0
TE	500	180	100	30	0	0	0
FO	6000	400	10000	300	9	1	0
TA	6000	130	4000	20	18	1	1
PA	3000	380	3000	150	16	1	1
CR	2000	600	800	50	4	1	1
Commercial							
NS	100	0	0	20	0	0	0
BG	200	0	0	10	0	0	0
BS	150	0	0	15	0	0	0
PG	250	0	0	20	0	0	0
PS	100	0	0	15	0	0	0
Residential							
HA	1250	50	100	5	0	1	0
HB	1250	50	100	5	0	1	0
HC	1250	50	100	5	0	1	0
MA	1100	40	80	5	0	1	0
MB	1100	40	80	5	0	1	0
MC	1100	40	80	5	0	1	0
LA	1000	30	70	5	0	1	0
LB	1000	30	70	5	0	1	0
LC	1000	30	70	5	0	1	0

Figure II-6

SAMPLING STATION REPORT: AMBIENT QUALITY JURISDICTION 2

LOCATION	BOD (LBS/MG)	CHLORIDES (LBS/MG)	NUTRIENTS (LBS/MG)	BACTERIALS (PARTS PER MG)	TEMPERATURE DEVIATION (DEGREES)	OIL AND FLOATING SOLIDS	HIGH LEVEL WASTES	AMOUNT OF WATER (MGD)	WATER QUALITY RATING
9620	0.0	0.0	10.20	0.0	0.0	NO	NO	260.00	1
9622	0.0	0.0	9.22	0.0	0.0	NO	NO	254.00	1
9624	0.0	0.0	7.86	0.0	0.0	NO	NO	280.00	1
9626	106.90	53.45	861.54	0.05	0.43	NO	YES	290.00	1
9612	0.0	0.0	0.0	0.0	0.0	NO	NO	100.00	1
9614	0.0	0.0	6.67	0.0	0.0	NO	NO	150.00	1
9616	0.0	0.0	9.70	0.0	0.0	NO	NO	200.00	1
9618	0.0	0.0	11.29	0.0	0.0	NO	NO	250.00	1
9628	131.41	50.92	799.11	0.43	0.0	YES	YES	300.00	8
9630	424.74	135.72	1150.11	1.08	10.66	YES	YES	500.00	8
9632	601.90	127.26	1125.40	0.98	7.45	YES	YES	510.00	9
9432	967.50	153.13	1982.20	29.53	5.15	YES	YES	520.00	9

TWOCITY
SAMPLING STATION REPORT: POINT SOURCE QUALITY JURISDICTION 1

LOCATION	OWNER	BUSINESS TYPE AND LEVEL	TREATMENT TYPE AND LEVEL	VOLUME (MGD)	BOD (LBS/MG)	CHLORIDES (LBS/MG)	NUTRIENTS (LBS/MG)	BACTERIALS (PARTS PER MG)	TEMPERATURE DEVIATION (DEGREES)	OIL AND FLOATING SOLIDS	HIGH LEVEL WASTES
9422	B	RA 1	0	0.10	1070.00	37.00	77.00	5.00	0.0	YES	NO
9424	C	RA 1	0	0.10	1070.00	37.00	77.00	5.00	0.0	YES	NO
8826	B	RA 3	0	0.35	1100.00	40.00	80.00	5.00	0.0	YES	NO
9026	F	RA 3	0	0.35	1100.00	40.00	80.00	5.00	0.0	YES	NO
9226	E	RA 3	0	0.35	1100.00	40.00	80.00	5.00	0.0	YES	NO
9426	E	RA 2	0	0.21	1100.00	40.00	80.00	5.00	0.0	YES	NO
8628	C	RA 3	0	0.24	1250.00	50.00	100.00	5.00	0.0	YES	NO
8828	B	RA 4	0	0.49	1100.00	40.00	80.00	5.00	0.0	YES	NO
9028	B	PS 1	0	0.18	100.00	0.0	0.0	15.00	0.0	NO	NO
9428	A	MF 0	0	0.0	0.0	0.0	0.0	0.0	0.0	NO	NO

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Figure II-7

EFFECTIVENESS OF TREATMENT TYPES:

PERCENT OF POLLUTANT REMOVED

Pollutant	Chlorination (CL)	Primary (PT)	Secondary (ST)	Tertiary (TT)
BOD	-	50	80	99
Chlorides	-	-	50	90
Nutrients	-	-	20	99
Coliform	99	99	99	100
Temperature	-	-	-	100
Oil and Solids	-	100	100	100
High Level Wastes	-	-	-	100

F. Effects of the Water Quality Index

The Water Quality Index on a parcel of land has direct effects on the following factors:

1. Treatment costs of water withdrawn from that parcel by the Water Department.
2. Treatment cost of water withdrawn by an industrial surface water user on that parcel.
3. The amount of personal consumption eminating from Major Recreation Areas located on or near that parcel.
4. The pollution index for that parcel.

The Pollution Index is a part of the Environmental Index which is used as a basis for determining the attractiveness of a residential parcel of land for potential in-migrants. A high Pollution Index also affects the probability of population units moving away from a residential parcel.

The Health Index for a parcel of land influences the amount of money spent by population units for health services and the amount of time lost from leisure activities. It also affects the Personal Index, which in turn influences the amount of dissatisfaction experienced by population units on a parcel. The Health Index for a parcel of land is based upon the concentration of coliform bacteria in the water. This is the only case in which a single component of the water quality index is handled separately.

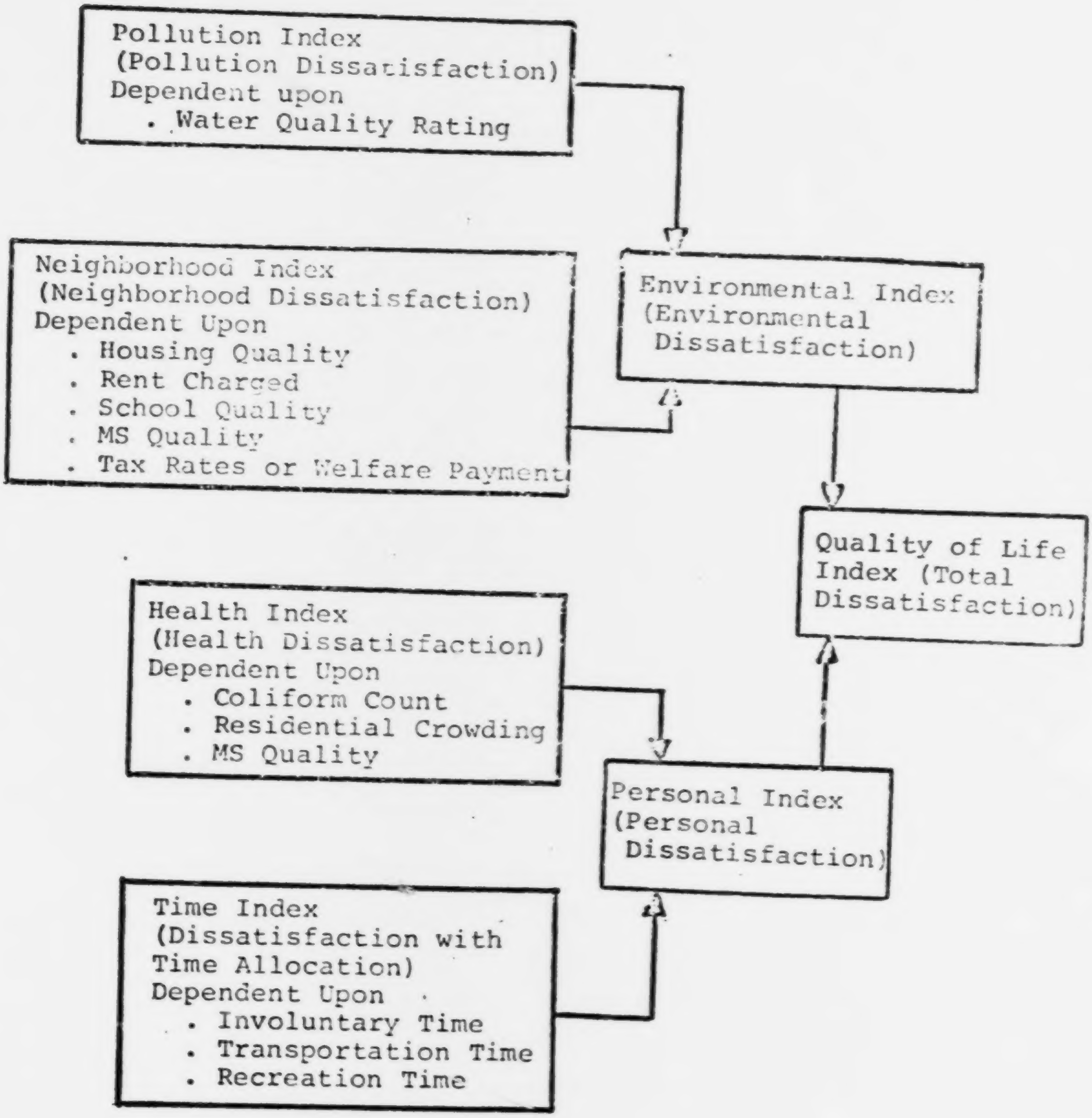
All of the dissatisfaction indexes and quality of life indexes are calculated in such a way that a high value indicates high dissatisfaction or low quality of life. In Figure II-8 the components of the Quality of Life Index are illustrated. For each of the indexes, the corresponding dissatisfaction term is provided in parentheses.

Note that both of the components of the Environmental Index are indexes which are based entirely upon locational quality factors outside the direct control of the social decision-makers. For example, social teams can only indirectly affect water quality, school quality and local tax rates.

The Personal Index, on the other hand, is comprised of two indices, one of which is based on locational quality factors while the other is based upon time allocation decisions that are largely within the control of the social decision-maker.

Figure II-8

COMPONENTS OF THE QUALITY OF LIFE INDEX


Pollution Index
(Pollution Dissatisfaction)
Dependent upon
. Water Quality Rating
Neighborhood Index
(Neighborhood Dissatisfaction)
Dependent Upon
. Housing Quality
. Rent Charged
. School Quality
. MS Quality
. Tax Rates or Welfare Payment
Environmental Index
(Environmental
Dissatisfaction)
Quality of Life
Index (Total
Dissatisfaction)
Health Index
(Health Dissatisfaction)
Dependent Upon
. Coliform Count
. Residential Crowding
. MS Quality
Personal Index
(Personal
Dissatisfaction)
Time Index
(Dissatisfaction with
Time Allocation)
Dependent Upon
. Involuntary Time
. Transportation Time
. Recreation Time

G. The Water and Sewer Office

The Water and Sewer Office is contained within the Utility Department, and it is charged with the responsibility of supplying the municipal water requirements within each of the utility districts. The water and sewer districts are identical to the utility districts.

The water office supplies water for a district by building a certain level of intake treatment plant on a parcel located within the same jurisdiction. The intake point does not need to be on the same parcel as the intake treatment plant. In fact, the intake point may be outside the utility district or even outside the jurisdiction. It must, however, be on a surface water parcel.

It is assumed that the cost of treating a unit of water (an MGD) is directly related to the quality level of the water. That is, it costs more to treat a unit of 8 quality water than a unit of 3 quality water.

If the total demand for municipal water within a utility district is larger than the amount that can be supplied by the intake plant, the municipal water users are obliged to purchase the needed amount of water from the outside system.

The total amount of municipally supplied water must also be returned to the local water system. It is up to each utility district to determine the amount of its water effluent that will be treated and the type of treatment. The four types of outflow treatment and the percent of each pollutant that is removed appeared earlier in Figure II-7.

H. The Interaction of the Water System with the Rest of the Model

The following description illustrates some of the features of the water component and the interaction between it and the rest of the model.

Figure II-9 shows the relationships between the water component and the three sectors of the model. In the economic sector, the quantity and quality of water in the local system affects some industrial users, land values (indirectly through the neighborhood index), major recreation facilities (and the consumption they generate).

The Social Sector is affected by the water quality and quantity through the health of the local population and the environmental index (whcih influences the outcome of migration). Government operation interacts with the water component through the fire protection process (which is dependent upon adequate water supply), the water quality agency (the local public body concerned with water quality), and the municipal water department which in turn supplies businesses and residences.

Actually, there may not be a Water Quality Agency in the local system, or there may be several that exist for different political jurisdictions. The game part of the Water Model allows much flexibility in the way this particular function is handled. Figure II-10 shows some of the interactions of the Water Quality Agency with the local system, once such an agency is in existence. The agency has legal options as well as the promotion of water treatment options by the public water and sewer authority at its disposal. The agency may also use its persuasive powers to line up support for its actions. The mix of policy that the agency undertakes will have effects on businesses and their treatment of or payment for effluent. The agency's policies will ultimately affect the people of the community and their standard of life in the local system. The Water Quality Agency will most likely be prompted to action through the complaints brought about by the population sector of the local community who find that sickness, lack of recreation, and other adverse effects result from water pollution. Complaints about poor water quality are also likely to arise from major water users who find their own inflow treatment costs to be increasing because of the deteriorating water quality.

The supply of municipal water in the local system is handled by a Water and Sewer Office. This department is concerned with the hydrological features of the local

Figure II-9

INTERACTION BETWEEN THE WATER COMPONENT AND THE THREE SECTORS OF THE MODEL

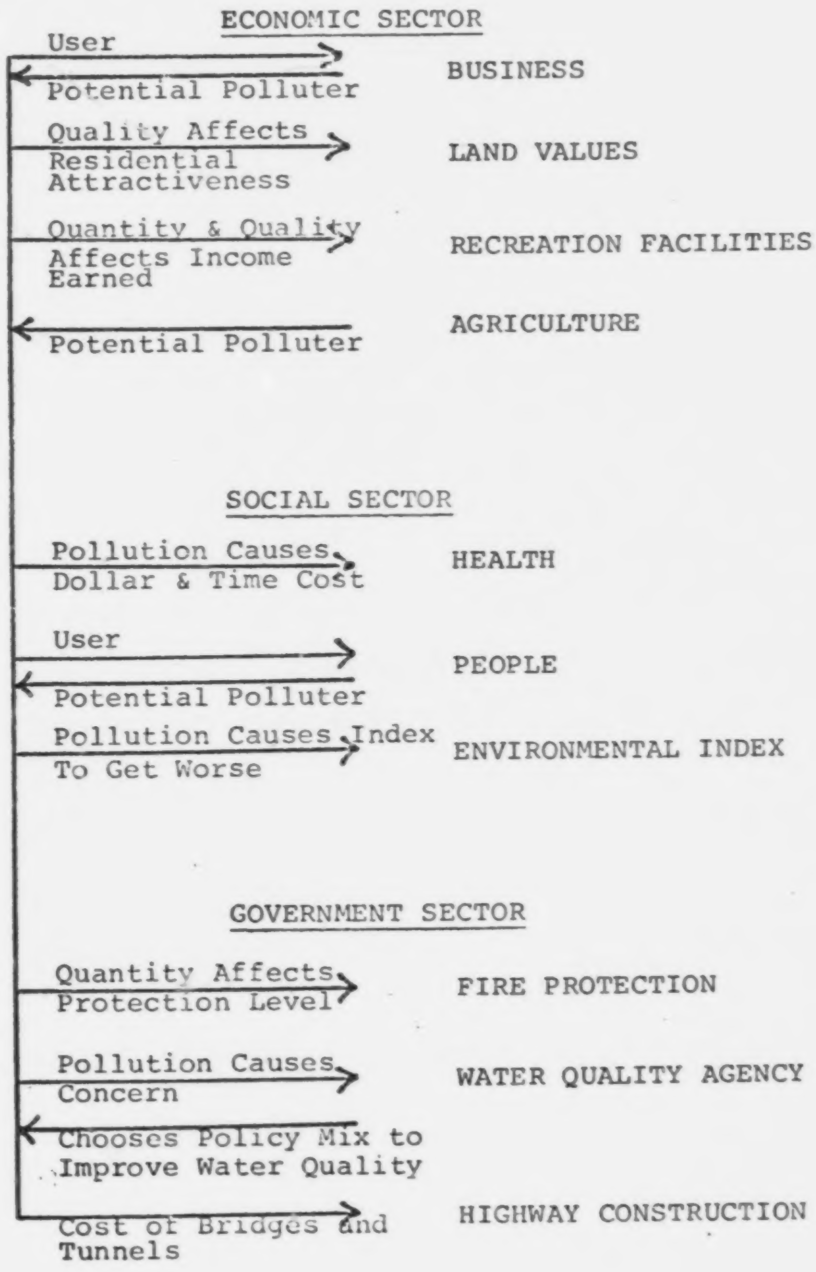
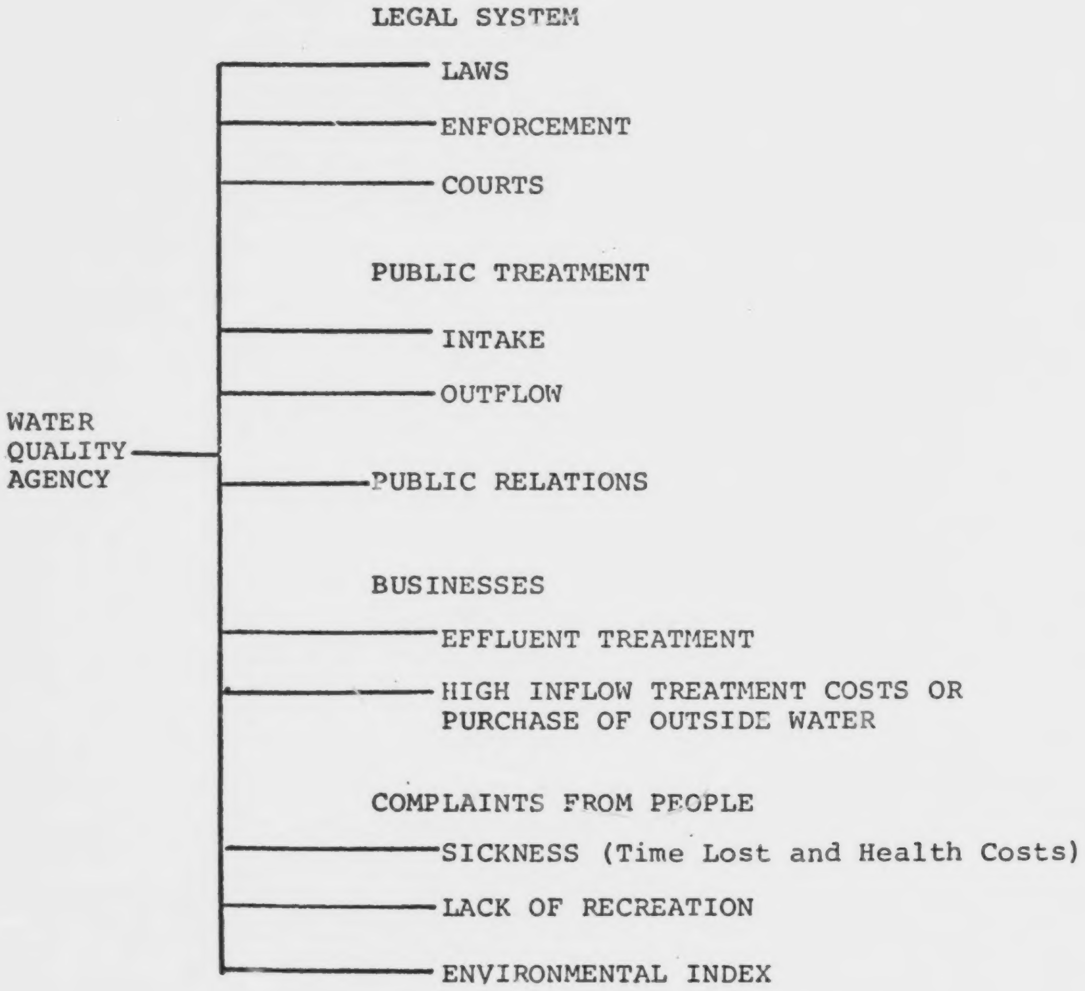

ECONOMIC SECTOR
User
Potential Polluter
BUSINESS
Quality Affects Residential Attractiveness
LAND VALUES
Quantity & Quality Affects Income Earned
RECREATION FACILITIES
Potential Polluter
AGRICULTURE
SOCIAL SECTOR
Pollution Causes Dollar & Time Cost
HEALTH
User
Potential Polluter
PEOPLE
Pollution Causes Index To Get Worse
ENVIRONMENTAL INDEX
GOVERNMENT SECTOR
Quantity Affects Protection Level
FIRE PROTECTION
Pollution Causes Concern
Chooses Policy Mix to Improve Water Quality
WATER QUALITY AGENCY
Cost of Bridges and Tunnels
HIGHWAY CONSTRUCTION

Figure II-10

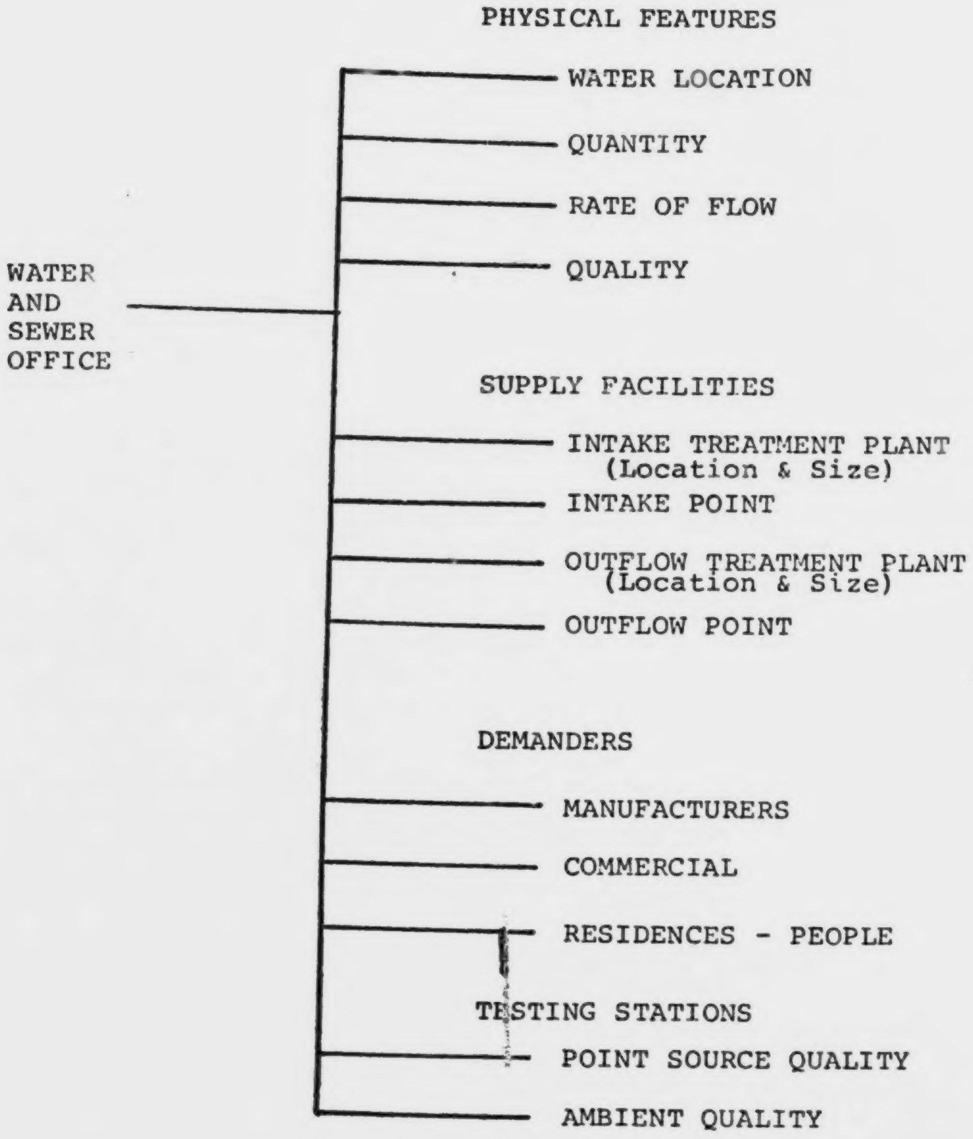
INTERACTIONS OF THE WATER QUALITY AGENCY WITH PARTS OF THE LOCAL SYSTEM


LEGAL SYSTEM
LAWS
ENFORCEMENT
COURTS
PUBLIC TREATMENT
INTAKE
OUTFLOW
WATER QUALITY AGENCY
PUBLIC RELATIONS
BUSINESSES
EFFLUENT TREATMENT
HIGH INFLOW TREATMENT COSTS OR PURCHASE OF OUTSIDE WATER
COMPLAINTS FROM PEOPLE
SICKNESS (Time Lost and Health Costs)
LACK OF RECREATION
ENVIRONMENTAL INDEX

environment. As shown in Figure II-11 the location of water, its amount, rate of flow, and quality is of concern to the department which has the responsibility to supply water to local demanders. To supply water, the department builds and operates intake treatment plants (at specific locations and of designated capacities) and specifies the water intake point associated with each plant. As part of the sewer responsibilities of the Water and Sewer Office, it also builds and operates water sewage outflow treatment plants (once again giving the location, treatment level, and capacity) and specifies an outflow point at which the water flows back into the local water system. The water supply authority sets a price on water for the various local demanders of water -- manufacturers, commercial activities, and residences.

Figure II-11

CONCERNS OF THE WATER AND SEWER OFFICE


WATER AND SEWER OFFICE
PHYSICAL FEATURES
WATER LOCATION
QUANTITY
RATE OF FLOW
QUALITY
SUPPLY FACILITIES
INTAKE TREATMENT PLANT (Location & Size)
INTAKE POINT
OUTFLOW TREATMENT PLANT (Location & Size)
OUTFLOW POINT
DEMANDERS
MANUFACTURERS
COMMERCIAL
RESIDENCES - PEOPLE
TESTING STATIONS
POINT SOURCE QUALITY
AMBIENT QUALITY

III. MAJOR COMPUTER PROCESSES

Regardless of what format is used to generate the decision inputs, the model executes the same major operating programs:

1. Migration-Housing
2. Water Quality Calculations and Effects
3. Depreciation
4. Employment
5. Transportation
6. School Allocation
7. Time Allocation
8. Commercial
9. Bookkeeping

1. Migration-Housing

The basic population grouping in the model is the population unit (P1). A P1 is designated as being a member of a socio-economic class. The one thing the three classes have in common is that 500 people comprise a P1. P1's move into, within, and out of the local system in response to available employment opportunities, housing quantity and quality, and a number of other factors.

This computer routine calculates dissatisfaction (environmental and personal); develops a pool of movers comprised of the population displaced by housing demolition, a percent of the most dissatisfied, a percent of the total population (random movers), natural population growth, and the in-migrants; and moves the members of this pool into housing that has adequate capacity and quality. A certain percentage of each income class that are either unemployed or underemployed outmigrate from the local system. Other movers who cannot find adequate local housing also become outmigrants.

Water quality affects migration through the environmental dissatisfaction (housing near polluted water becomes less attractive) and through the personal dissatisfaction (bad health resulting from nearby polluted water increases the probability of moving).

2. Water Quality Calculation and Effects

The water quality on each parcel of land that contains water is calculated by combining the pollution flowing into the parcel from up to three upstream sources (water from adjacent parcels) with the quantity of water on the parcel. This mixing process generates a water quality index for water on that parcel for all users on that parcel (industries, municipal water systems, and major recreation areas). That portion of the water which is not withdrawn has a certain amount of pollution disappear based upon the rate of flow of the water. All water returned to the water system on that parcel (industrial waste, municipal outflow, and farm run-off) is combined with the water not withdrawn, and a calculation of the total amount of pollution sent to the next parcel downstream.

This process is performed for each parcel of land that contains a moving body of water. The operation of industries, municipal water systems, farms, and dams affect the water quality along different stretches of a river. The water quality then affects next year's migration and this year's depreciation and commercial activity (via major recreation areas) as indicated in the following sections.

3. Depreciation

Buildings and roads depreciate in value and utility each year as a function of the passage of time (obsolescence), the amount of use they receive (wear and tear), and the quality of local municipal services (especially police and fire protection). Local decision makers may choose to maintain a constant value for their developments by expending the requirec amounts of money for maintenance. This routine depreciates all developments and calculates maintenance expenditures.

Three additional water-related factors can also contribute to the rate of annual depreciation of developments. First industries that draw water directly from nearby water supplies have an additional depreciation that is in proportion to the water quality rating of the water they use. Second, for utility districts that have insufficient supplies of water, there is an additional depreciation that reflects above average fire damage due to inadequate water for fire fighting purposes. Third, developments may experience increased depreciation as a result of flood damage. This damage is related to the severity of the flood (input by the director), the type of building, its location in the flood plain, and the flood control priority of dams for the river basin (if there are any).

4. Employment

All Pl's in the local system compete with one another for jobs in the local labor market. Likewise, all employers compete to hire workers with the highest education levels. There are two types of employment - full-time and part-time.

The full-time employment routine assigns population units (high income first and best educated first) to full time jobs based on the assumption that workers will attempt to maximize their net salary (salary received minus transportation costs using last year's transportation cost figures). Pl's will take jobs in the next lower class if none are available in their class. The part-time employment routine assigns part-time workers (80 time units in part-time work equals one full-time job) to part-time jobs on the basis of best education first. The number of time units allocated to part-time jobs is set for each group of Pl's on a parcel by the social decision-makers. If time is allocated for part-time work, but not enough part-time jobs exist, the dissatisfaction of the Pl's is increased.

If plants that are causing water pollution are shut down or forced to curtail output, then the reduction in the required labor force will have its repercussions throughout the system. The employment routine treats the former employees of the shut down plant as unemployed at the start of the routine and assigns them to other jobs if extra jobs are available in the local system.

5. Transportation

Pl's that are employed are assigned to a mode of travel and to a specific route by this computer routine. Taking the origins (homes as determined in migration) and the destinations (jobs as determined in employment) this allocator assigns workers to transportation mode and routes in an effort to minimize total transportation costs (dollar costs plus the dollar value of time spent) subject to the constraints imposed by public transit capacity, road congestion, and transportation boycotts.

Each employer may offer a unique salary; Pl's from a single parcel may be employed at several different locations, and three transportation modes (auto, bus, and rapid rail) may be considered. Government decision-makers may affect the transportation access (and thereby indirectly affect employment choices) by choosing where to build roads of different capacities, where to run bus lines, what fare to charge, and where to build and operate rapid rail service.

6. School Allocation

Each Pl contains a number of school age children who attend public schools, if the public schools are available and meet quality criteria that differ by income class. This routine assigns students by class (low class first) to public schools or private schools based upon school quality criteria (quality of plant and equipment, quality of teachers, and the student-teacher ratio) and capacity of the school serving their district. Population units who send their children to private schools as a result of local public school deficiencies must bear the cost of such private education.

Another school allocation routine assigns adults from Pl's to public adult education programs in proportion to the amount of leisure time allocated by Pl's to such programs. The local education authority provides public adult education programs by hiring teachers and using existing educational facilities. If Pl's are not able to spend as much in adult public education programs as they wanted, then their personal dissatisfaction increases.

7. Time Allocation

For each Pl grouping, time spent in transportation is deducted from a total of 100 units; then time spent in part-time employment is deducted; public adult education time is deducted; private adult education costs are determined and the time is deducted; voter registration is changed as a result of the time spent in politics and the time is deducted; and time is deducted for time spent in recreation, and consumption of PG and PS is increased above the normal amount. The remaining time is labeled "involuntary" time, which contributes to the level of dissatisfaction calculated for the following year.

8. Commercial

Each Pl grouping must purchase units of personal goods and units of personal services each year. Establishments that sell personal goods and personal services must sell exclusively to local system demanders. These establishments compete with one another through locational advantages and by prices for a unit of goods or services sold. In the commercial routine, the purchases (normal and recreation-related) of the population groups on a parcel and residential maintenance expenditures are allocated to personal goods and personal services establishments using the criteria that establishments have a limited capacity and that shoppers attempt to minimize total costs (sale price plus transportation charges).

In a similar fashion, purchasers of business goods and business services must buy annually from BG and BS establishments. These establishments compete with one another to supply the local demand. In the commercial routine, the purchasesof businesses (including personal goods and personal services establishments) for normal operation and for maintenance are allocated to business goods and business services establishments based upon the same criteria as above (an infinite-capacity outside supplier sells goods and services at prices in excess of normal local prices).

The amount of purchases from local personal goods and services establishments is affected by the normal amount of business generated by Major Recreation Areas and the present quality rating of the water bodies serving those recreation areas. Thus, consumption at local stores will rise somewhat with good water quality and fall with poor water quality. This consumption is assumed to be made by tourists from outside the local system.

9. Bookkeeping

This routine makes all the final calculations of incomes and expenditures and of indicators for use in the detailed computer output to the economic activities and teams, the social decision-makers, the government departments, and the summary statistics.

IV. THE FULL-TIME EMPLOYMENT PROCESS

This explanation is intended to supplement the description of the employment process given in the CITY4 Player's Manual.

Sequence of Operations

The employment process can be viewed as a series of steps:

Steps 1-7 are executed for high-income first and low-income last.

1. Calculate the least transportation cost from each parcel where the class lives to each employment location which hires P1's of that class. Least transportation cost is calculated using last round's route and modal usage, this round's transportation system, and this round's dollar value of time set by the social decision-maker controlling the class on the parcel. Any destinations (employment locations) which cost more to travel to than a fixed percentage of the salary offered there are not considered to be possible destinations for a P1. The percentage is applied to the actual travel cost; the shadow time cost is not considered. That percentage is set by the model director and varies by class. The transportation parameters used are those associated with the P1's class, not the class of job being sought.

Note: The cheapest route is the same for all workers of a class on a parcel.

2. Create a list of all P1's. Each entry in the list is an "employment group", a group of P1's living on the same parcel who worked for the same employer in the previous round. The list is ordered by educational level, highest first, with all P1's living on the same parcel grouped together. If P1's living ontwo or more parcels have the same educational levels, the order of those parcels in the list is randomly selected. Within a parcel's group, the order is by last year's net income (salary minus transportation cost), lowest first.

3. For each employment group, increase the net income which could be earned this year at last year's employment location by 10 percent.

4. For each employer, create three lists: 1) number of job openings; 2) number of jobs which have been taken by P1's who worked there last round; and 3) number of jobs which have been taken by P1's who did not work there last round. Initially the second and third lists are zero.

5. Take the first employment group in the list and compare the weighted net income at last year's employment location with the highest net income which could be earned at another employment location. If the weighted net income at the previous job is higher, subtract the second list at that employment location from the first list. The result is the

number of jobs which the employment group can take at that location. Assign as many P1's in the employment group as there are job openings to that employment location and enter that number in the second list for the employment location.

If the weighted net income at the previous job location is lower than the net income which could be earned at another job, subtract the sum of the second and third lists at the latter from the first list there. The result is the number of jobs which the employment group can take at that location. Assign as many P1's in the employment group as there are job openings to that employment location and enter that number in the third list for the employment location.

Repeat this step for those P1's in the employment group who were not assigned, and for all other employment groups.

6. List all P1's who did not take their old jobs (those in employers' third lists, those who did not find jobs in step 5, those who were unemployed last round, and those who are new in-migrants) in order of educational level, as in step 2.

7. Take the first employment group in the list. Assign as many P1's from it to its best (highest net income, with the previous job's income still weighted) employment location as there are jobs there. Any P1's from the group for whom there are no jobs there take jobs at the second best location, and so on. Repeat this step for each group in the list until either all groups have been processed or all jobs have been filled.

8. Repeat steps 1-7 for the next lower income class and those P1's of this class who did not get jobs.

9. After all three classes have been processed, repeat step 1 for all three classes, using as destinations the employment locations selected in steps 5 and 7.

10. Calculate the congestion generated by step 9 for each road, bus, and rail segment. A bus or rail segment is an interval between two successive stops.

11. If the congestion created by step 9 exceeds last round's final congestion on any segment by more than 10 percent plus the percent increase in population between the two rounds, repeat step 9 but use the route and mode congestion calculated in step 10. Congestion is overusage; as long as a segment is uncongested, its usage does not affect the determination of whether to repeat the transportation assignment process.

12. Repeat step 11 using criteria generated by the most recent two transportation iterations.

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13. Register the final actual transportation costs paid by each P1 (not including the shadow cost due to time), register the time spent travelling, compute final road, bus and rail usage, register the actual salary earned by each P1 (not including the shadow salary used when a P1 decides whether to work at its previous job location).

Discussion

There are situations in which some workers may be unemployed while there are job openings in their class. Such would occur when the workers cannot get jobs within their maximum transportation range, either because there are no jobs within that range or because all job openings within that range have been taken by previous employees or by workers having higher educational levels.*

It is also quite possible that workers in one class will be unemployed while there are job openings in the next lower class, even though the workers in the higher class are first to be processed for the lower class jobs. The main reason for such a situation is that the maximum transportation range (maximum percent of salary offered at an employment location which a worker will pay in order to get there) and transportation cost (by auto) parameters vary by class.** The higher the class, the higher its transportation cost but the lower its maximum transportation range as a percent of salary offered. The salary offered to a class is usually about half the salary offered to the next higher class, but the maximum transportation range and auto costs used are for the class seeking employment.

For example, suppose that an employer offers $5,000 to PM and $10,000 to PH. PM and PH are living on the same parcel, and it would cost PM $520 to get to the employment location and PH $620 to get there. Suppose further that a PM will pay up to 15 percent of the salary offered to get to a job and PH will pay up to 10 percent (these are the actual design parameters unless the director changes them in the loaded data base). Then the PM could pay up to $750 (.15 x $5,000) to get to the job, but PH could pay only $500 (.10 x $5,000) to get there. The PH could not even consider taking a job at that location, but the PM could.

The reason for the two phases of job assignments (steps 5 and 7) is that without the first-phase bias for an employee to keep his old job, there is much more job switching in the model than occurs in reality. In counteracting massive job changes, the bias dampens the assumption built into much of the model that people have perfect information about local conditions and that they make selections only for the reasons represented in the model. In the migration process these design problems are handled by having some movers selected randomly and by ordering the list of Pl's seeking housing randomly. Although housing quality is ordered from best to worst, there is no bias toward a particular Pl's taking that housing except its placement in the Pl list. The weight of 10 percent of the salary offered at the previous job location is somewhat arbitrary.

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* Of course, any jobs within the transportation range but which are being boycotted by the P1's are not even considered as possible employment locations.

** Dollar value of time, which varies by class and is usually higher for PH than for PM, is not a factor in determination of maximum transportation range.

The employment process is designed to further limit the number of Pl's changing jobs in that a Pl for whom there exists a job with a greater net income than the weighted net income at his old job does not automatically give up his option on his old job regardless of whether the new job is open (i.e., not already filled by a former employee) or whether anyone with a higher educational level would also be seeking that job. A Pl first checks to see whether he has a chance of getting a preferred new job before giving up his old job. Since the list of job applicants is ordered by educational level, those Pl's entered in an employer's second list (those who have decided to work for the employer again) are hired before a Pl who worked there last round but who has a lower educational level, but the Pl with the lower educational level is hired before any Pl's who did not work there last round (those who are in the employer's third list). If the Pl finds that a job other than its old one has the highest net income, it first considers whether the number of former employees already hired there plus the number of Pl's having higher educational levels (i.e., Pl's processed before it and therefore already on the employer's third list) who prefer that job exceed the number of job openings there. Thus, the Pl does not give up its option on its old job only to lose the new job during the second phase to a Pl who has a higher educational level. In fact, a Pl with a higher educational level may not get its preferred job (if it is in an employer's third list) during the second phase because a former employee with a lower educational level exercised its job option.

The whole point of the first phase is to determine which Pl's are exercising the option to stay where they are, thus avoiding the second phase's competition of educational levels. In the first phase, only those Pl's taking their previous jobs are actually assigned to jobs. An alternative method of assigning workers to jobs while cutting down on the number of workers switching jobs would be to have only a portion of the Pl's consider assignment to new jobs. Such a process gets very complicated (more than the present method) and results in much greater distortion than the present method.

V. THE MIGRATION PROCESS

1. Summary

Unlike the employment process, the migration process operates on all three classes at once. First, a percentage of the unemployed and underemployed P1's are moved out of the local system, thus vacating their local housing. Then, for any housing which remains over 120% occupied (such would be the case if a fully occupied residence unit were partially or totally demolished), enough P1's are removed to reduce the occupancy to 120%. A percentage of the total population, selected randomly from each class, also vacates its housing. Another 10% of the local population is selected to vacate its housing due to dissatisfaction.

After all of the local movers have been selected and have vacated their housing, they, together with inmigrants and natural population growth, seek housing in the local system. Those who do not find housing leave the local system.

2. Index Calculations

The diagram on the next page shows the components of each index which contributes to the Quality of Life Index.

The Environmental Index is a characteristic of a parcel; the Personal Index is a characteristic of people.

a. Environmental Index

(1) Pollution Index

If a parcel has surface water, the pollution index is:

$$(W-3.5)^3$$

where W is the surface water quality rating this year.

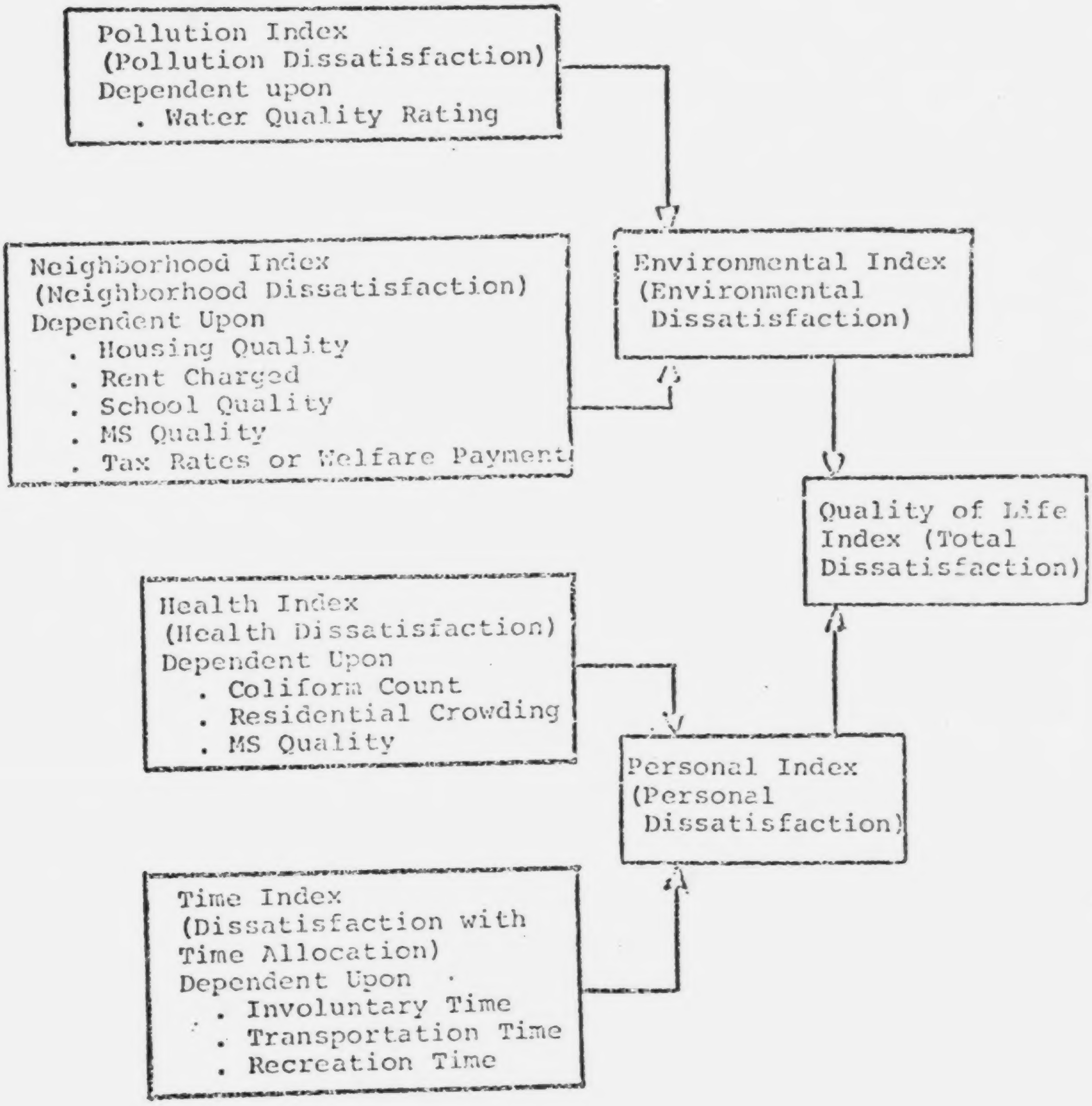
If a parcel does not have surface water but does border (on at least one full side) a parcel which has surface water, its pollution index is half of the average pollution indexes of those parcels which it borders and which have surface water.

(2) Neighborhood Index (No components of the Neighborhood Index can be negative)

(a) Residence Quality:

$$C-Q$$

COMPONENTS OF THE QUALITY OF LIFE INDEX


Pollution Index
(Pollution Dissatisfaction)
Dependent upon
. Water Quality Rating
Neighborhood Index
(Neighborhood Dissatisfaction)
Dependent Upon
. Housing Quality
. Rent Charged
. School Quality
. MS Quality
. Tax Rates or Welfare Payment
Environmental Index
(Environmental
Dissatisfaction)
Quality of Life
Index (Total
Dissatisfaction)
Health Index
(Health Dissatisfaction)
Dependent Upon
. Coliform Count
. Residential Crowding
. MS Quality
Personal Index
(Personal
Dissatisfaction)
Time Index
(Dissatisfaction with
Time Allocation)
Dependent Upon
. Involuntary Time
. Transportation Time
. Recreation Time

where Q is the residence quality index this year and C is a constant which varies by class (for low, C=70; for middle, C=90; for high, C=100)

(b) Residence Rent:

(R-T) * D

where R is the rent charged per space unit at the residence this year

and T is the typical rent charged to the class (a loaded data base parameter)

and D is a constant which varies by class (for low, D=3; for middle, D=2; for high, D=1)

(c) MS Use Index:

MS-100

where MS is last year's use index of the MS now serving the parcel.

(d) School Use Index:

SC-100

where SC is last year's use index of the school now serving the parcel.

(e) Tax Rates (for PM and PH only):

1/4 point for each mil resident income, services, and goods tax rate and 1/8 point for each mil land and developments tax rate in the jurisdiction this year.

(f) Welfare Rates (for PL only):

(2000-W)/25

where W is the welfare payment per unemployed worker in the jurisdiction this year.

(3) Personal Index

(a) Health Index (No components of the Health Index can be negative)

MS: (MS-100)/4

where MS is last year's use index of the MS unit now serving the parcel.

Residential Crowding:

(P-100)/.8

where P is the percent occupancy of the residence last year.

Coliform:

If the parcel has surface water, the coliform component of its Health Index is:

C/4

where C is the coliform parts/MG in the surface water at the time that the surface water is assigned its quality rating this year.

If a parcel does not have surface water bur adjoins (touches at least a corner) a surface water parcel, its coliform component is that of the adjoining parcel having the highest coliform component.

This component has a maximum value of 50.

(b) Time Index:

Involuntary Time:

1 point for each time unit in involuntary activity last year.

Transportation Time:

5 points for each average time spent in transportation last year.

Recreation Time:

Subtract 1 point for each time unit spent in recreation last year. For each point over 100 of last year's use index of the park with the highest use index within a 3-parcel radius of the parcel, the time subtracted here is decreased by 1 percent.

3. Outmigration due to unemployment and underemployment

Of those Pl's who are unemployed or underemployed, 33% of PH, 25% of PM, and 15% of PL automatically out-migrate and vacate their housing.

4. Selection of those seeking housing

a. Displaced due to overcrowding

After the outmigrating Pl's described in 3 above are removed from their housing, percent occupancy is recalculated. Pl's are then selected to move out of overcrowded housing

(housing over 120% occupied). Usually, overcrowded conditions exist only when residences have been demolished. However, the director may have loaded a city with cases of over 120% occupancy. When more than one class lives on an overcrowded parcel, the displaced Pl's are removed in proportion to the number living there in each class.

b. Most Dissatisfied in the System

A randomly selected half of the 20% of each class's (Pl's with the highest Quality of Life Indexes) move out of their housing. The total number of Pl's used here includes those unemployed and underemployed who automatically outmigrate.

c. Randomly Chosen in the System

Of the other 80%, a random 1% of Pl's, 5% of PM's and 7% of PH's vacate their current housing.

d. In-Migrants*

The number of in-migrants from the Outside System in any class is 1% of the number in the class in the local system plus one Pl for each job which is vacant at the beginning of this round (in HI, LI, NS, BG, BS, PG, PS, CI, Bus, Rail, SC, and MS). The number of jobs previously filled but which have been eliminated due to demolition or cutbacks are subtracted from the vacancies counted.

e. Natural Population Growth*

1-1/2% of the total population of each class is added to the number of in-migrants in order to represent the natural population growth.

5. Housing Placement

The list of Pl's looking for housing is randomly ordered. Each Pl takes the best (lowest Environmental Index) acceptable** available housing. If the best housing would be over 120% crowded if the Pl were to move in, the Pl looks at the second best acceptable housing. (A residence's Environmental Index is raised 1 point for every 1% over 100% occupancy.)

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*Note: The director may use his control over the absolute number of in-migrating population units by class to override the calculations of number of in-migrants and natural population growth.

** Acceptable housing is housing with a QI ranging from 20 to 70 for low, 40 to 100 for middle, and 71 to 100 for high.

Those who vacated their housing for reasons of dissatisfaction or random selection who cannot find acceptable local system housing with an Environmental Index below their previous Environmental Index will out-migrate. The other types of housing seekers outmigrate only if they cannot find acceptable housing.

Within a single migration cycle, a Pl which vacates its housing for any reason cannot move back into that housing.

When a Pl moves into a residence, its education level and voter registration are averaged with those of the inhabitants in its class and it takes the same preferred time allocation as the previous residents. If a Pl moves into a residence which was previously unoccupied by its class, its characteristics and preferred time allocation are the same as they were at its previous residence location, or, in the case of new inmigrants, the characteristics and preferred time allocations shown in the table below.

	Class		
Time Allocation Units	PL	PM	PH
Extra job	40	30	20
Free Education	20	30	0
Pay Education	0	5	20
Politics	10	20	40
Recreation	20	10	10
Characteristics			
Education Level	15	55	85
Voter Registration	100	40	200
Previous Savings	0	0	0

If more than one Pl moves into a housing unit previously unoccupied by that class and the Pl's have different characteristics (time allocation, education level, voter registration, and previous savings), the characteristics of the first Pl group to choose the housing are assumed for all the Pl's.

A Pl which moves from one place in the local system to another keeps its previous job location. Although its previous job may not turn out to be its best job after the move, there is still the bias toward retaining the previous job.

VI THE COMMERCIAL ALLOCATION PROCESS

OVERVIEW

Each round the commercial allocation process assigns buyers to sellers, each buyer being assigned to shop at the commercial establishment at which the buyer can obtain his required goods or services most cheaply. The cost which a buyer perceives at each of his options for a shopping location is a function of the transportation cost to get to the location, the crowding at that location, the seller's price, and the buyer's preference for shopping at the establishment where he shopped the previous round. Every buyer evaluates all possible shopping locations each round.

The allocation process is iterative. Each buyer selects the shopping location which is cheapest for him, and after all buyers have selected shopping locations, all reevaluate their selections in light of the crowding created by the previous selection process. The entire selection process is repeated until between two successive evaluations no buyers decide to change their selections from the previous iteration. Every buyer evaluates all possible shopping locations each iteration.

There are several reasons for the iterative procedure. No business has an infinite capacity in terms of the number of customers whom it can serve or the number of goods or services which it can provide. Thus, the usage of an establishment by other shoppers is a factor in a buyer's decision as to whether to shop there. Crowding, or overusage, at a commercial establishment can be viewed as a cost to the buyer in terms of annoyance, poor or inadequate service, or length of time waiting for an appointment.

The allocation process could assign buyers to sellers one at a time, each buyer considering the usage created by all buyers processed before him. However, those buyers selected for assignment first would have the advantage of seeing unused sellers, and since crowding is only one factor in the determination of "cheapest", those buyers would tend to purchase goods and services at the least dollar cost to them. Buyers selected later for processing would tend to find the cheapest sellers in dollar cost too crowded and therefore too expensive. Such a procedure of assignment introduces non-systemic biases in the selections of shopping locations. The bias would be a result of the order in which buyers are selected for assignment, and not a result of local system conditions.

The actual allocation process employed by the model assigns all buyers to sellers simultaneously. Each commercial establishment's usage as seen by a prospective customer is affected by the establishment's usage after the previous iteration, or in the case of the first iteration in a round, affected by the establishment's usage after the final iteration in the previous round. The perceived usage is only affected by the previous usage. If the previous usage were always the perceived usage, the selections of shopping locations would tend to flip-flop from one iteration to the next. Since prices at commercial establishments and cheapest transportation costs from buyers to sellers do not change between iterations, only usage would cause a location to appear more desirable in one iteration than in another iteration. Buyers would tend to flock to one location on one iteration and, in the next iteration, see that location as overcrowded and all flock to another location. On the following iteration the first establishment would appear underused and the buyers would all return. So, the actual usage of a commercial establishment is adjusted in the allocation process to a "base perceived" usage. With each iteration of commercial allocation in a round, the effect of the actual usage of a commercial establishment tends to decrease relative to the base perceived usage of that establishment.

The shadow cost for a buyer to shop at a commercial establishment is a function of: 1) its base perceived usage; 2) the added usage which would result if the buyer were to shop there but did not shop there on the previous iteration; 3) the establishment's effective capacity; 4) its price; 5) the buyer's least transportation cost to travel to the location; and 6) the buyer's bias toward shopping where he shopped last round. The result of this function is the shadow cost to a buyer to shop at each commercial establishment. Each buyer selects the commercial establishment with the least shadow cost to him. If the least shadow cost is the Outside System, the buyer does not use a local establishment.*

A buyer's actual expenditure is the real transportation cost and actual price charged at the commercial establishment which he selects on the final iteration.

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*Note: The Outside System as a seller of goods and services has only a price. It has no perceived usage, an infinite capacity, and no transportation cost. A buyer who shops Outside does not have a bias toward shopping there in the following round.

The commercial allocation process can be viewed as a series of steps:

1. Calculate the effective capacity of each commercial establishment.

2. Calculate the least transportation cost from each buyer to each seller.

3. Calculate the base perceived usage of each commercial establishment. (This is the only reiterative step for the sellers. The remaining calculations are performed for each buyer as he considers each seller.)

4. From each buyer's point-of-view, adjust the base perceived usage of the commercial establishment to reflect its usage if he were to shop there but did not shop there on the previous iteration.

5. Use the result of step 4 as the numerator in a fraction for which the result of step 1 is the denominator. This is the shadow ratio of perceived usage to capacity.

6. Apply the shadow ratio to the function shown on the graph in Figure 1. Determine the y-coordinate which corresponds to the appropriate ratio.

7. Sum the price per unit charged at the commercial establishment and the least cost per unit purchased for the buyer to travel to the commercial establishment.

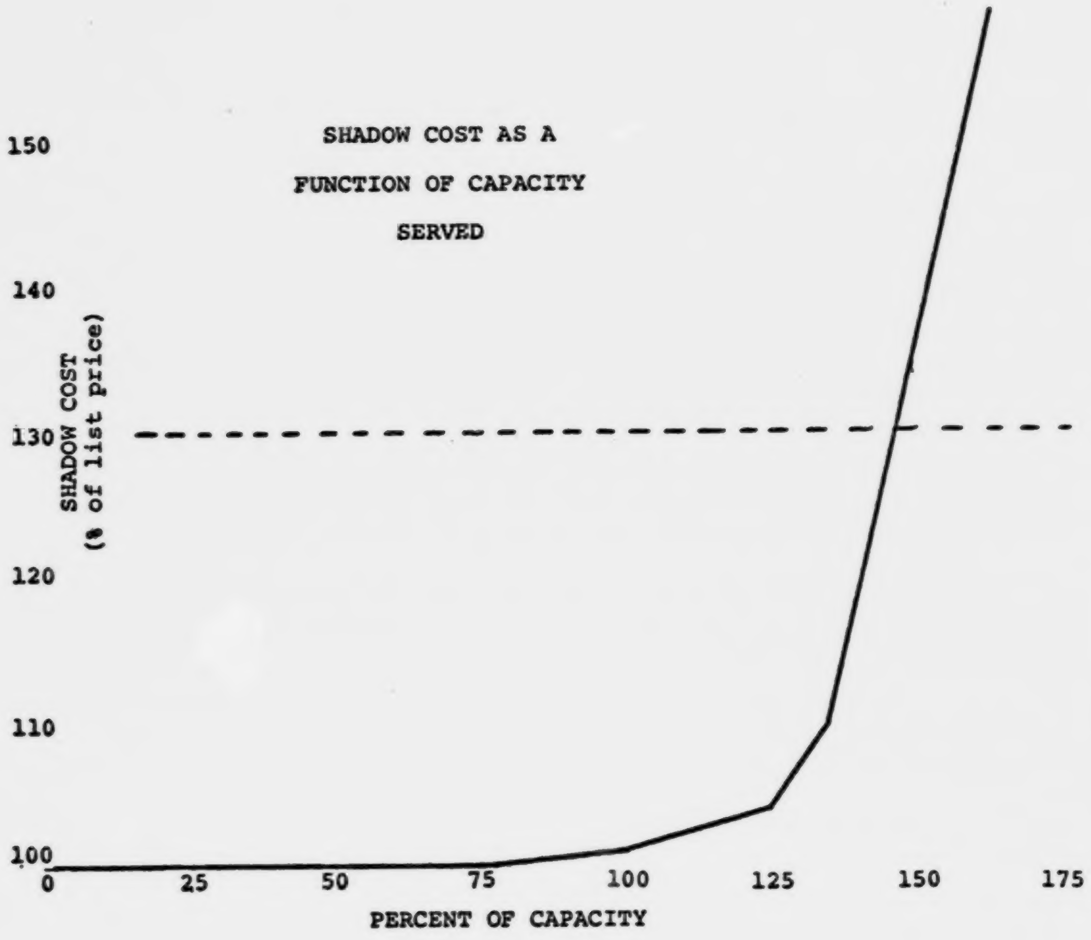
8. Multiply the result of step 6 by the result of step 7.

9. If the buyer shopped at the commercial establishment last round, multiply the result of step 8 by .9.

10. The result of steps 8 and 9 is the shadow cost for the buyer to shop at the commercial establishment. (Repeat steps 4-10 for each seller which the buyer can consider.)

11. Assign the buyer to the commercial establishment which has the least shadow cost for him. (Repeat steps 4-11 for each buyer.)

12. Determine whether another iteration is necessary. If so, repeat steps 3-11. If not, all assignments are final for the round.

SHADOW COST AS A
FUNCTION OF CAPACITY
SERVED
SHADOW COST
(% of list price)
150
140
130
120
110
100
0
25
50
75
100
125
150
175
PERCENT OF CAPACITY

DETAIL ON PARTS OF THE ALLOCATION PROCESS

The commercial process is run first for buyers of PG and PS. PG and PS establishments are buyers of BG and BS, and their purchases are a function of their sales. Thus, customers are allocated to PG and PS before any customers are allocated to BG and BS. The two allocation processes are identical except for the consideration in the BG-BS allocation of usage by government departments which have contracts consuming capacity at some commercial establishments.

Step 1. Calculate the effective capacity of each commercial establishment.

A business's effective capacity is a function of its level, its type of business, its value ratio, and the number of employees which it received through the employment process in relation to the number of employees which it requires in order to operate at its level. The Outside System, one seller of goods and services, has an infinite capacity.

E = Effective capacity of a commercial establishment

PR = Total number of P1's required by the establishment

PH = Total number of P1's hired by the establishment in the employment process

VR = The establishment's value ratio

C = Design capacity of the establishment (the capacity of a level one of the business type times the establishment's level)

$$E = PH/PR \times VR/100 \times C$$

Step 2. Calculate the least transportation cost from each buyer to each seller.

The transportation network used for commercial travel includes the roads only. Bus and rail are not modal options. The roads are viewed as unused by all travellers; road congestion is not a factor in the selection of least transportation cost. The selection process itself uses the Moore algorithm to calculate least transportation cost from each buyer to each seller.

Step 3. Calculate the base perceived usage of each commercial establishment.

V_{i+1} = The base perceived usage or a commercial establishment to be used in iteration i+1

S_i = The actual usage of the commercial establishment in iteration i

K = A constant 20/21

N = The number of previous iterations in the round in which either:
1) the number of buyers who changed their shopping locations was greater than or equal to the number who changed shopping locations on the previous iteration, or
2) no buyers changed shopping locations but the difference between the actual usage (S) at a commercial establishment and the base perceived usage (V) was greater than 20 capacity units.

N is incremented if either of the two conditions listed above obtains within an iteration, and the new value of N is used in calculating the next iteration's V.

$$V_{i+1} = S_{i+1} * K^{(N)} + (1.000 - K^{(N)}) * V_i$$

Step 12. Determine whether another iteration is necessary. If after step 3 both 1) no buyer changed his shopping location, and 2) the base usage of each commercial establishment is within 20 capacity units of its actual usage, then the allocation process is finished and the shopping assignments are final for the round. If either of the two criteria for finality is not met, steps 3-11 are repeated, using the results of this iteration.

VII. THE SCHOOL ALLOCATION PROCESS

1. For each school, calculate its value ratio after depreciation and after maintenance.

2. For each school, calculate the total number of students in each class living in the school's district.

3. Multiply the number of PH Pl's requested by the school times 120 and multiply the result by the number of PH teachers hired by the school's jurisdiction divided by the number of PH teachers requested by the school's jurisdiction. The result is the number of high-income teachers working at the school.

4. Multiply the number of PM Pl's requested by the school times 160 and multiply the result by the number of PM teachers hired by the school's jurisdiction divided by the number of PM teachers requested by the jurisdiction. The result is the number of middle-income teachers working at the school.

5. Divide the result of step 3 by the result of step 4. This is the ratio of PH to PM teachers at the school.

6. Sum the result of step 3 and the result of step 4. This is the total number of teachers working at the school.

7. Assign all of the low-income students in the school's district to the school.

8. If the school's value ratio is less than 60 or if the ratio of PH to PM teachers (step 5) is less than .75, no middle income students are assigned to the school. If the value ratio is 60 or greater and the ratio of PH to PM teachers is .75 or greater, then the number of middle-income students assigned to the school is the lesser of the number of middle-income students living in the school's district or the total number of teachers working at the school (step 6) times 22 less the number of low-income students assigned to the school. In effect, as many middle-income students are assigned to the school as there are room for without causing a student-teacher ratio greater than 22/1.

9. The procedure for determining the number of high-income students assigned to a school is the same as for middle-income, except that the minimum value ratio is 80, the ratio of PH to PM must be greater than 1, the maximum student-teacher ratio is 18/1 and the number of middle-

income students already assigned is considered in addition to the number of low-income students already assigned.

10. The number of PM students assigned to the school is divided by the number of PM students in the school's district. The same is done for PH.

11. For each class living on each residence parcel in the school's district, the number of students is multiplied by the result of step 10 appropriate for the class. The result is the number of students in the class on the parcel attending the public school serving the district in which the parcel is located. The remaining students attend private school.

This allocation procedure causes all of a class in a district to be affected by school quality equally in proportion to the number of students living on each parcel in the district.

VIII. EDIT ERROR MESSAGES

The EDIT program processes decisions one at a time in the order in which they are submitted to it by the director. The program checks the data submitted to it for two kinds of errors: coding (incorrect format for a decision or keypunch errors) and legality (violation of a rule of the model, such as construction without utilities or sale of land belonging to another decision-maker). When an error message is printed, the decision to which it applies has been rejected, with a few exceptions which are noted in the explanation of the error messages. In all cases, if a decision does not receive an error message, the program has accepted and processed the decision.

GENERAL ERROR MESSAGES

For all general errors, an indicator (Δ) points to the approximate location of the error.

1. INVALID $ ENTRY

Incorrect general decision code. All subsequent decisions using this $ entry will be invalidated.

2. INVALID TEAM ENTRY

There is a mistake in the team identification in the decision-maker location of the input card. Might be caused by omitting second slash or mispunching "=".

3. NO CURRENT VALID $ ENTRY

No valid general decision code has been entered or the last one entered is in error. This usually occurs after a #1 error.

4. NO CURRENT VALID TEAM ENTRY

No valid team identification has been entered in the decision-maker location of the input card or the last one entered is in error.

5. NO RIGHT PARENTHESIS

The right hand parenthesis for an input requiring one has been omitted. All lists, and only lists, must be enclosed in parentheses.

6. NO LEFT PARENTHESIS

The left hand parenthesis for an input requiring one has been omitted.

7. INVALID LOCATIONS LIST

A list containted a mixture of parcel (even-even), intersection (odd-odd) and road locations (even-odd or odd-even).

8. INCORRECT PUNCTUATION

The indicator points to the incorrect punctuation. Examples: comma (,), slash (/), etc.

9. INVALID LAND USE

A wrong two-letter abbreviation for a land use was used.

10. INVALID TEAM

A team identification (in a position other than where decision-maker is specified) is not a valid team name.

11. MORE THAN 15 CHARACTERS

More than 15 digits fall between two successive commas. This might result if commas were omitted from the input card.

12. NUMBER TOO HIGH

Too large of a number has been input. Check the input explanation form to see if scaling has been observed.

13. NUMBER TOO HIGH OR TOO LOW

The entered number is not within the prescribed limits of this particular entry.

14. INVALID CHARACTER IN NUMBER

An extraneous character has been added to a number. This could be a dollar sign for a land bid or price. Note that all figures are coded without commas.

15. LIST NOT PERMITTED

Parentheses have been used to include several entries where only one entry is allowed.

16. INCORRECT LOCATION ENTRY

The decision contains something other than a location on the board in a position which should contain a location.

17. BLOCK ENTRY NOT PERMITTED

Opposite corners have been used to specify a zone when a zone is not permitted. Another way to put it is that in this list the character ">" is invalid.

18. INVALID ROAD COORDINATES

The program accepts only even-odd or odd-even combinations that are on the board.

19. MORE THAN 65 LOCATIONS IN LIST

When block input is used, a maximum of 65 parcels can be specified between the parentheses.

$ASMNT

1. SOMEONE ON TEAM (team name) IS TRYING TO ENTER ASSESSMENT INPUT

A decision-maker other than AS has input a decision using this code.

2. LOCATION ERROR

A road or intersection was specified. Assessment locations must be parcels.

3. NO PARCEL LIST FOR ASSESSMENT

A location has not been specified in column "C" for a type of assessment decision which requires a location (AD, AL, SL, SD).

4. (location) IS IN (jurisdiction)

The decision-maker has attempted to assess a parcel which is in another jurisdiction.

5. UNNECESSARY PARCEL LIST FOR ASSESSMENT

A location has been specified in column "C" for a jurisdiction-wide decision setting the assessment ratio of a land use.

6. (code) IS NOT A RECOGNIZABLE CONTROL WORD

An incorrect letter code has been used.

7. _______ IS NOT A FARM PARCEL

A farm assessment has been input for a parcel which is not a farm.

$BUILD - $OUBLD

1. (team) CAN'T BUILD (land use)

A decision-maker has attempted to build a type of land use not allowed him.

2. OU PRICE NON-NEGOTIABLE

A price has been entered in a $OUBLD input.

3. _____ IS NOT A JURISDICTION

The jurisdiction number input by a government department is not valid.

4. (location) UNASSIGNED

The indicated parcel is not assigned to a utility district. This message prints if there is a construction on a parcel which was loaded with utilities but not assigned to a utility district.

5. (team) OWNS (location)

The decision-maker specified on the decision input as owning a location does not actually own that parcel.

6. (location) IS UNDEVELOPED

A non-zero old level has been input for a parcel which is undeveloped.

7. (location) IS A FARM OWNED BY (team)

The input specified a construction on a farm parcel.

8. (location) IS NOT A (land use), IT IS A (land use)

A land use has been input with a previous level, but the parcel is not developed in that land use.

9. THERE'S NO (land use) AT (location)

The input specifies an existing land use on a parcel but the parcel does not contain that land use.

10. (land use) AT (location) IS LEVEL ______

The old level of development input does not equal land use's actual level.

11. ___% IS REQUIRED ON (location) - ONLY ____% IS AVAILABLE

The team does not own sufficient land on the parcel for the intended construction.

12. JURISDICTION ____ IS RESPONSIBLE FOR (location)

A road or terminal construction decision has been input by a jurisdiction which does not control that location.

13. (location) IS IN (jurisdiction number)

The parcel is not in the jurisdiction of the decision-maker.

14. LEVEL ERROR

Old and new levels are identical.

15. QI ERROR

The quality index input is less than 40 or greater than 100.

16. ONLY RA'S CAN HAVE PRIVATE UTILITIES

A land use other than RA has attempted to be constructed using private utilities.

17. LOCATION ERROR

The land use specified cannot be at the designated location. Such would be the case if a road were specified for a parcel or if an economic activity were specified on a road or intersection.

18. COST TO (team) FOR BUILD ON (location) IS $(price) ONLY HAS $(capital balance)

The team constructing does not have enough money to pay for the attempted construction.

19. REQUIRES LEVEL (number) UTILITY SERVICE - ONLY HAS LEVEL (number)

The level of utility service installed on the parcel does not provide as many utility units as are required by the new level of development.

20. EXCEEDS UTILITY PLANT CAPACITY

The number of utility units which the proposed construction requires plus the number of utility units already served by the utility plant which serves the parcel on which the construction is located exceeds the plant's capacity (2400 times the plant's level).

21. REALLOCATION OF SERVICE MUST PRECEDE DEMOLITION

There has been an attempt to demolish a utility plant without first assigning all of the parcels served by that plant to another utility plant.

22. UNITS CONSUMED MUST BE DECREASED TO (number) BEFORE DEMOLITION

There has been an attempt to decrease the level of a utility plant when the plant already serves more than 2400 times its new level.

23. (UT or CI) CAN ONLY BUILD OUTSIDE

There has been an attempt to build a utility plant or a construction industry with the $BUILD input code.

24. JOB EXCEEDS (CI location)'S CAPACITY (number of equipment units required for the construction) / (number of equipment units remaining in the CI's capacity)

The CI does not have enough remaining capacity to perform the construction.

25. (team) HAS AN OUTSTANDING CONTRACT TO BUILD A (land use) AT (location)

A team (contractee) has input a construction contract for a land use and location for which it already has a contract.

26. (location) IS ZONED (zoning code) WHICH PROHIBITS (land use)

The attempted construction violates zoning.

$BYCT

1. E OR S

A letter other than E or S was in column "a".

2. (department) DOES NOT BOYCOTT

A government department appears as the decision-maker. Departments do not boycott.

3. U S OR W

A letter other than U, S, or W appeared in column "c".

4. WORK BOYCOTTS ARE SOCIAL BOYCOTTS

An economic decision-maker tried to input a decision to boycott work. Economic decision-makers can only input shopping boycotts.

5. (location) IS NOT A (LNDUSE or CLASS)

A social boycott has been input with a letter in column "b" which is not a class or a land use in column "d" which is not an acceptable land use code.

6. U IS FOR SYSTEM-WIDE BOYCOTT OF BUS OR RAIL BY SOCIAL CLASS

A location has been input for a use boycott.

7. ENTER S OR B FOR STOP OR BEGIN

A letter other than S or B was used in column "e".

8. (team) CANNOT BOYCOTT (department)

A shopping boycott has been input against a department.

9. (location) IS UNDEVELOPED

The location boycotted (column "d") is undeveloped.

10. (location) IS A RESIDENCE

The location boycotted (column "d") is a residence.

11. (location) IS A (land use)

A shopping boycott has been input at a location which is not commercially developed.

12. (team)'S (class or land use)'S ARE NOT BOYCOTTING (SHOP, WORK, or USE) - (location or department)

An S in column "e" has indicated that an existing boycott is to be stopped, but the boycott does not exist.

13. (team)'S (class or land use)'S ARE ALREADY BOYCOTTING (SHOP, WORK, or USE) - (location or department)

An attempt was made to begin a boycott which already exists.

14. (department) DOES NOT HIRE

An attempt was made to boycott work at a department that does not hire population units.

$CASH

1. (code input) IS NOT A VALID CODE

The letter code in column "a" is not a valid letter code.

2. AS HAS NO CASH

The Assessment Department has been designated as a giver or receiver of cash. AS does not have an account.

3. (FOURTH or FIFTH) ENTRY MUST BE CAP OR CUR

A cash transfer involving a government department must specify the department's capital or current account. If CAP or CUR is used to designate an economic team's account, the designation is ignored and is assumed by the program to be PVT.

4. (team: PZ or CH) HAS ONLY A (CAPITAL or CURRENT) ACCOUNT

Either Chairman or Planning and Zoning has been designated as having an account which it does not in fact have.

5. ONLY CHAIR MAY USE (code input)

A team other than the Chairman has used a code other than C in column "a".

6. (team) DOES NOT RECEIVE APPROPRIATIONS

Chairman has attempted to grant an appropriation using CP or CR to an economic team, UT, RAIL, or CH.

7. NOT AN APPROPRIATION - DIFFERENT JURISDICTIONS

Chairman has attempted to grant an appropriation using CP or CR to a department in another jurisdiction, or BUS or RAIL.

8. WRONG SUBSIDY

The Chairman has either used SB in column "a" to subsize UT, BUS, or RAIL or used CURS or CAPS in column "a" to subsize an economic team. CURS and CAPS are used for departments; SB is used for economic teams.

9. (team) DOES NOT RECEIVE SUBSIDIES

Only UT, BUS, and RAIL can receive subsidies through CURS or CAPS.

10. LOCATION ENTRY REQUIRED FOR (social team)'S (class)

A cash transfer involving a social decision-maker has omitted the residence location of the Pl's.

11. THERE ARE NO (class) Pl'S ON (location)

A cash transfer involving a social decision-maker has specified a parcel on which no Pl's of the designated class live.

12. (social decision-maker) DOES NOT CONTROL (class) ON (location)

The social decision-maker designated as controlling a class on a parcel does not in fact control those Pl's.

13. (social team)'S class ON (location) ONLY HAVE $ (savings)

The social decision-maker attempted to transfer an amount greater than the number of Pl's times the sum of the savings per Pl and the miscellaneous income per Pl. Note that miscellaneous income is negative if the class has transferred more money than it has received.

14. THERE IS NO (department and jurisdiction)

The jurisdiction number input for a department exceeds the number of jurisdictions being used in the model.

15. NULL TRANSACTION

A decision-maker has attempted to transfer money from an account to the same account. For economic, the giver and receiver would be identical; for government, the giver and receiver would match and both accounts would be capital or current; for social, the giver and receiver would match, the class giving and receiving would match, and the locations would match.

16. (team) ONLY HAS $(amount)

A team has less money in its capital account (total capital revenue less capital expenditures) than it is attempting to transfer. Note that there is no check on a transfer from a current account.

$CVPT

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1. (code input) IS NOT A VALID CODE

A code other than one allowed by $CVPT or $OTHER has been input in column "a".

2. THERE IS NO UTILITY PLANT ON (location)

The utility plant location specified in column "c" does not contain a utility plant on a decision to change utility service.

3. THE PLANT AT (location) IS UNDEVELOPED

The Utility Department has only undeveloped land at the location specified in column "c" on a decision to change utility service.

4. (location) IS IN JURISDICTION (number)

The location designated in column "c" is in a different jurisdiction from the one of the Utility Department which input a decision to change utility service.

5. (number) IS NOT A VALID UTILITY LEVEL

The new level of service specified on a decision to change utility service is not a number between 0 and 9.

6. LOCATION ERROR

A location other than a parcel has been specified in column "b". The location should be a parcel.

7. (UTILITY or INTAKE or OUTFLOW) PLANT AT (location) CAN'T CHANGE

An attempt has been made to change the utility district in which a parcel containing a utility, inflow, or outflow plant is located. The utility district to which such a parcel is assigned cannot be changed until the appropriate plant(s) has been demolished.

8. (location) USES MORE THAN (number)

The private development on the parcel for which there was an attempt to change the level of utility service requires more utilities than the new level of service would provide.

9. INSTALLATION AT (location) COSTS $(amount) (department) ONLY HAS $(amount)

The Utility Department has insufficient funds in its capital balance to perform the installation of utility services.

10. NON-CONNECTABLE - (location) (location) etc.

Each listed parcel is not contiguous to a parcel having utilities and served by the designated utility plant. Contiguous parcels are the eight parcels surrounding a parcel.

11. TEAM (team name) DOES NOT (input code)

A decision-maker has input a decision type in column "a" which he is not allowed to make.

12. (zoning code input) IS NOT A VALID ZONING CODE

The two-digit zoning code input in column "c" on a decision to change zoning is not one of the zoning codes allowed in the model.

13. (input code) IS TOO (HIGH or LOW)

The value given to a rent (R), salary (S), maintenance level (M), price (P), number of employees (E), public institutional land (PI or RPI), BG-BS contract percent of purchases (C), or preempted land (PLND or RPLND) exceeds the maximum or minimum amount allowed that value.

Function	Input Minimum	Input Maximum
Rent (R)	0	250
Salary (S)	PL 12	50
	PM 25	100
	PH 50	200
Maintenance Level (M)	0	100
Price (Utility)	0	1600
Price (BG-BS)	500	1500

Function	Input Minimum	Input Maximum
Price (PC-PS)	50	150
Employees (E)	0	6
All others	0	100

Note: all of these limits are overridden if there is a "1" in column "f".

14. (PI, RPI, PLND or RPLN) REQUIRES SPECIFICATION OF PERCENT OF PARCEL

Column "c" did not contain a specification of what percent of the parcel was to be changed.

15. (PI or RPI) COSTS $(amount) - PZ (jurisdiction) ONLY HAS $(amount) IN CAPITAL FUNDS

The Planning and Zoning Department does not have sufficient funds to carry out the transaction involving public institutional land.

16. (location) MAINTENANCE SET TO MAXIMUM -- (maintenance level)

There was an attempt to increase the maintenance level of a residence to more than 20 points above the lowest quality index which the residence ever reached. The program changes the desired maintenance level to the maximum allowed and then accepts the decision. This is one of the few error messages that do not indicate total rejection of a decision.

17. ONLY (number)% OF (location) IS (PI or PLND)

There was an attempt to take more land out of public institutional or preempt use than was actually in that use.

18. (team)'S (BG or BS) AT (location) HAS NO CONTRACT WITH (department)

There was an attempt to cancel a BG or BS contract, but the contract did not exist.

19. USE $OTHER FOR (input code)

The $CVPT code was used when $OTHER should have been used.

20. (team) OWNS (location)

The economic decision-maker specified on the decision input as owning a location does not actually own that location.

21. (location) IS UNDEVELOPED

An economic decision-maker has attempted to change something on a parcel which is undeveloped.

22. (location) IS A (land use) AND DOES NOT (SET PRICES, EMPLOY, SET RENTS, or CONTRACT)

An economic decision-maker has attempted to make a decision which is not allowed for the economic activity type located on that parcel.

23. THERE'S NO (MS, SC or PI) AT (location)

A MS or SC department tried to change a maintenance level or employee request at a parcel on which the department has no constructed facility, or PZ tried to remove public institutional use of parkland from a parcel on which none exists.

24. (number)% IS REQUIRED ON (location) - ONLY ____% IS AVAILABLE

PZ does not have enough parkland at the location to develop or remove the amount of public institutional land (PI or RPI), or there is not enough privately-owned and undeveloped land on the parcel for the director to create or remove preempted land (PLND or RPLND).

25. (location) IS IN (jurisdiction)

The parcel is *not* in the jurisdiction of the decision-maker.

26. (location) IS A FARM OWNED BY (team)

An economic decision-maker specified not a business or residence parcel but a parcel which is part of a farm. Decisions regarding farms use $ODDS or $PU.

$ENDS

1. (code input) IS INVALID CODE

A code other than L, R, W, or P has been input in column "a".

2. (land use) AT (location) DOES NOT RECYCLE

The land use at that location is not a basic industry, so it cannot recycle water.

3. OPERATING LEVEL (number) AT (location) IS TOO HIGH

An economic decision-maker has attempted to raise the operating level at a business above its constructed level. The operating level cannot be above the constructed level.

4. (location) IS NOT A LAKE PARCEL

The director attempted to specify water quality on a parcel which does not contain a lake.

5. (number) IS INVALID WATER QUALITY

The specified water quality is not an integer between 1 and 9.

6. NO WATER ON (location)

The director attempted to specify a miscellaneous pollution input on a parcel which has no water.

7. (location) IS UNDEVELOPED

There was an attempt to set an operating level at a parcel which is undeveloped.

8. (location) IS RESIDENTIAL

There was an attempt to set an operating level at a parcel which is developed residentially.

9. NO VOLUME OF POLLUTION INPUT FOR (location)

The director specified miscellaneous pollutants to be dumped on a parcel but did not specify a volume of effluent.

10. (location) IS A FARM OWNED BY (team)

The location is not a business which can recycle or set an operating level; it is a farm.

11. (team) OWNS (location)

The economic decision-maker specified on the input as owning a location does not actually own that parcel.

12. TOO MANY POLLUTANTS ENTERED FOR (location)

The director specified miscellaneous pollutants to be dumped on a parcel but listed more than seven pollutant types and one water volume.

$FSA

1. (team) CANNOT REQUEST FEDERAL-STATE AID

The decision-maker is a department other than SC or HY, which are the only departments which can request Federal-State aid.

2. SC MUST INPUT PARCEL COORDINATES TO FSA

A School Department did not specify the parcel location for which aid was requested.

3. HY MUST INPUT ROAD COORDINATES TO FSA

A Highway Department did not specify the road location for which aid was requested.

4. PARCEL AT (location) IS NOT IN JURISDICTION OF (department)

A School Department has requested aid to build on a parcel which is not in its jurisdiction.

5. ROAD AT (location) NOT IN JURISDICTION OF (department)

A Highway Department has requested aid to build at a location which is not in its jurisdiction.

6. (HY or SC) AT (location) IS LEVEL (number)

Aid has been requested for a level of construction that is less than or equal to the existing level of development at the location.

7. LEVEL (number) AID IS AVAILABLE FOR (HY or SC) AT (location)

Aid has already been granted for a development at the location for a level greater than or equal to the requested level.

8. (department) HAS ENTERED (number) REQUESTS

The School or Highway Department has already made the maximum number of FSA requests allowed it in a round. Schools can make 3 requests; Highways can make 5 requests.

9. AID REQUEST OF (department) FOR (location) (GRANTED or DENIED)

This message states whether or not the department's aid request was granted.

$ODDS

1. (number) IS INVALID RIVER BASIN

The code number of the river basin input on a decision to set dam priorities does not match the code number of any river basin on the board.

2. INVALID FLOOD LEVEL IN RIVER BASIN (number)

The director has input a flood level which does not fall between 1 and 100.

3. INVALID FARM CODE NUMBER, (farm code input)

A decision to set a fertilizer level specified a farm code number that does not match that of any farm on the board.

4. INVALID FERTILIZER FACTOR, (number)

The fertilizer level specified is not between 0 and 3.

5. (team) OWNS FARM (number)

The decision-maker does not own the farm having the code number which he specified.

6. (code input) IS INVALID CODE

A letter code other than A, B, C, F, or R appeared in column "a".

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$OTHER

1. (code input) IS NOT A VALID CODE

A code other than one allowed by $OTHER or $CVPT has been input in column "a".

2. TEAM (team name) DOES NOT (input code)

A decision-maker has input a decision type in column "a" which he is not allowed to make.

3. $(amount) NEEDED - $(amount) AVAILABLE

The Bus or Rail Company has attempted to purchase rolling stock costing more than its available capital funds.

4. (BUS or RAIL) ONLY HAS (number) UNITS

The Bus or Rail Company has attempted to sell more rolling stock than it owns.

5. USE $CVPT FOR (input code)

The $OTHER code was used when $CVPT should have been used.

6. (team) DOES NOT SET WELFARE

A decision-maker other than a Chairman has input a decision with "W" in column "a". W is for setting welfare payments only.

7. PAYMENT IS TOO HIGH

The Chairman attempted to set the welfare payment higher than the maximum of $10,000 per unemployed worker. The coded input for the payment should be 100 or less.

8. EA IS AN INVALID CODE

A department other than Schools has used the code "EA" in column "a".

9. (PZ or CH) CANNOT FLOAT (2 or 25) YEAR BONDS

Planning and Zoning has attempted to float a 2-year (current) bond or Chairman has attempted to float a 25-year (capital) bond. PZ has only a capital account; Chairman has only a current account.

10. INTEREST RATE IS (number)%

This message merely shows the interest rate set for a bond or loan from the Outside. The transaction is complete; this is not an error message.

11. SCALE BOND IN 10,000'S

If a bond for $900 million or more is input, the program assumes that the dollar amount was incorrectly scaled. The decision is rejected.

12. ONLY 2 OR 25 FOR TERM

A bond or loan was input with a term other than 2 or 25.

13. ILLEGAL DEPARTMENT

A department has attempted to make a decision which is not allowed it.

14. ILLEGAL ROAD TYPE

The road type specified is not 1, 2, or 3.

15. (team) ONLY HAS (amount)

A team has attempted to lend more money than it has available.

16. USE BONDING ROUTINE

Either a department used "LO" in column "a" or an economic team used LO but did not specify a borrower or an interest rate. Bonds and loans from the Outside use "BO" in column "a".

17. SCALE LOAN IN 10,000'S

If a loan for $900 million or more is input, the program assumes that the dollar amount was incorrectly scaled. The decision is rejected.

18. INVEST COSTS $(amount) - (team) ONLY HAS $(amount) IN CAPITAL FUNDS

An economic team has attempted to invest more money in stocks than it has in available cash.

19. (team) ONLY HAS $(amount) IN (SPECULATIVE or CONSERVATIVE) INVESTMENTS

An economic team has attempted to sell more investments than it has.

20. THERE IS A CI AT (location)

The director has attempted to specify NOCI, but there is still at least one C1 on the board. All C1's must be demolished before NOC1 is accepted by the program.

21. (amount) LOAN EXCEEDS LIMIT OF (amount that can still be borrowed)
TOTAL DEBT LIMIT IS (amount) PRESENT DEBT IS (amount)

The economic team has attempted to borrow more money from the Outside than its debt limit allows. There is no limit on the amount which a team can borrow from another team.

$PU

1. OUTSIDE DOES NOT BUY LAND

"OU" was input on the decision-maker purchasing a parcel of land. The Outside cannot purchase land.

2. (department) CAN'T OWN LAND

CH, AS, or BUS was input as the decision-maker purchasing a parcel of land. Those departments cannot own land.

3. DIFFERENT AREAS

Departments in different jurisdictions attempted to transfer land.

4. ONLY DEPT'S SELL PART TO PVT

A private team attempted to purchase part of a parcel from a private team by specifying a number other than "0" in column "d".

5. (location) COSTS $(amount) - (team) ONLY HAS $(amount)

The buyer does not have enough funds to make the land purchase.

6. (team) OWNS (location)

The private owner of a parcel specified in column "c" is not the parcel's actual private owner.

7. (location) IS IN (jurisdiction)

The parcel is not in the jurisdiction specified on the input.

8. (team) CAN ONLY SELL (amount) ON (location)

A team has attempted to sell more land on a parcel than it has undeveloped there.

9. (team) (amount) BID ON (location) (ACCEPTED or REJECTED) (probability) / (random number)

If the probability is less than the random number, the bid has been accepted. This is not an error message; it reports the outcome of an unsolicited bid on Outside-owned land.

$RAIL

1. TEAM (team name) CANNOT ENTER RAIL INPUT

   A team other than RAIL has used the $RAIL code.

2. LIST MUST BE OF PARCELS

   The list of parcels over which the track being constructed is on the surface contains a location which is not a parcel.

3. SAME INTERSECTION PAIR TO BUILD RR (location)

   On a decision to build a track segment the same intersection was given for the beginning and end points. If a station is to be constructed, only one intersection is specified. If a track is to be constructed, two different intersections are specified.

4. RAIL SEGMENT FROM (intersection location) TO (intersection location) NOT BUILT

   There is already a track between the designated intersections, so a new one was not put there by the program. There can be only one track directly between two intersections.

5. *** NO RAILROAD LAND ON PARCEL (location)

   The Rail Company does not own any land on a parcel where it has specified that track will be on the surface.

6. *** PARCEL (location) WAS NOT SPECIFIED

   A parcel on which a surface track segment must be located in order to connect the designated intersections was not specified on the input as being a parcel over which a surface track would go. A track segment directly connecting two stations must be either entirely on the surface or entirely underground.

7. NOT A VALID INTERSECTION OR INTERSECTIONS ARE EQUAL (location) (location)

At least one of the locations is not an intersection location or the intersections are identical.

8. RAIL ONLY HAS $(capital balance) - NO STATION BUILT AT (location)

The Rail Company does not have sufficient funds to construct the designated station.

9. STATION ALREADY EXISTS AT (location)

There is already a rail station at the location where a station was to be constructed by the decision input.

$REDIST

1. LOCATION ERROR

   A road or intersection was specified in column "b" where a list of parcels should appear.

2. NO PARCEL LIST INCLUDED FOR REDISTRICTING

   Column "b" was blank. A list of parcels to be added to the district should appear there.

3. TEAM (name) CANNOT REDISTRICT

   A team other than MS or SC tried to use the $REDIST input code.

4. (location) HAS NO (MS or SC)

   The location specified in column "a" does not have a school or MS on it.

5. (location) IS IN JURISDICTION (number)

   A school or MS location which is not in the jurisdiction of the decision-maker has been specified in column "a".

6. PARCEL AT (location) IS NOT IN JURISDICTION OF TEAM (name)

   A parcel which is not in the jurisdiction of the decision-maker has been specified in column "b".

After all decisions have been processed, the program checks that districts consist of contiguous parcels. One of two error messages indicates that redistricting has failed:

1. PROPOSED REDISTRICTING RESULTS IN DISTRICT FOR (SC or MS) AT (location) BEING DISCONTINUOUS

   The district which was to have been served by the school or MS does not consist of contiguous parcels.

2. THERE IS NO LONGER A (SC or MS) AT (location)

A redistricting decision would have added parcels to a district in which the school or MS was demolished.

In either case, the error message is followed by:

(SC or MS) REDISTRICTING FOR JURISDICTION (number) REJECTED

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$ROUT

1. *** BUS OR RAIL NOT SPECIFIED

A decision-maker other than BUS or RAIL used the $ROUT input code.

2. *** ROUTE NOT FOUND

There was an attempt to eliminate a route by specifying a new level of 0 in column "c", but there is no route with the code number specified in column "a".

3. *** NO INTERSECTIONS SPECIFIED

A list of intersections where a route is to go (column "d") included either one or no intersections.

4. *** BUS ROUTES MUST FOLLOW ROADS

Two successive intersections do not lie along the same row or the same column, i.e., the part of the bus route specified attempts to cross parcels diagonally. Bus routes must follow roads, i.e., the segments must be horizontal or vertical.

5. NO ROAD (EAST, WEST, NORTH, or SOUTH) FROM (intersection)

A bus route has been specified as travelling along a roadbed. Bus routes must be along roads.

6. *** NO TRACK FROM (intersection) TO (intersection)

A rail route has been specified between two intersections which are not directly connected by a track segment.

7. *** NO STATION ON (intersection)

There is no station at a location which has been designated as a rail stop.

$TAXES

1. (number) EXCEEDS TAX MAXIMUM OF 99

The maximum tax rate of 9.9% has been exceeded by the decision. The maximum limitation is waived if there is a "1" in column "c".

2 ONLY CH1, CH2, or CH3 CAN ENTER TAXES

A decision-maker other than a Chairman has used the $TAXES code.

3. L, D, RI, EI, RA, EA, G, or S

A code other than one listed above was used in column "a".

$TIME

1. ONLY PVT ALLOCATES

Only a social decision-maker can input a time allocation decision.

2. ONLY L1, L2, L3, M1, M2, M3, H1, H2, OR H3

These population unit codes by jurisdiction are the only ones allowed (column "a").

3. HIGH CAN'T ALLOCATE FREE SCHOOL

Time for PH has been allocated to free education (column "b").

4. TIME ADDS TO (total of units if over 100)

An allocation of more than 100 time units was attempted.

5. LOCATION ERROR

If intersection or road segment is input as a location for P1's.

6. (team) DOES NOT CONTROL (H, M, or L) ON (location)

A team has attempted to make time allocation decisions for a class on a parcel over which it does not have control.

7. THERE ARE NO (H, M, L)'S ON (location)

Time has been allocated for a class of P1's on a parcel where no members of that class reside.

8. (location) IS IN (jurisdiction number)

If the specified location is not in the jurisdiction indicated by the number after H, M, or L (column "a").

9. LOW CAN'T ALLOCATE PAY SCHOOL

Time for PL has been allocated to pay education.

10. (team) DOES NOT CONTROL POPULATION

The social decision-maker input on the decision is not a valid social decision-maker as specified when the original data base was loaded.

$VALUE

1. (team) DOES NOT SET TIME VALUE

A team other than a social decision-maker has attempted to use the $VALUE code.

2. L, M, or H

Column "a" contains a character other than L, M, or H.

$WRBLD

1. (location input) IS NOT LEGIT LOCATION

The location input in column "b" is not a parcel location on the board.

2. (code input) IS INVALID CODE

The program did not recognize the letter code input in column "a".

3. (location) IS INVALID DISTRICT PLANT LOCATION

The parcel specified as having a utility plant does not in fact have a utility plant on it.

4. (code input) IS INVALID TREATMENT TYPE

The type of effluent treatment plant input is not CL, PT, ST, or TT.

5. (code input) IS INVALID I-O CODE

The code input is not "IN" or "OUT".

6. (location) HAS NO TREATMENT PLANT

A Utility Department tried to build a treatment plant in a district which already has a treatment plant of that type (type being intake or outflow). The other treatment plant must be demolished before a plant at a different location in the same utility department can be constructed.

7. NOT ENOUGH LAND AT (location)

The Utility Department does not have enough land for the desired treatment plant construction.

8. (location) IS INVALID (A, P, or M) SAMPLING STATION LOCATION

The type of sampling station input cannot function at the location input. For A, the location must have surface water; for P, the location must have an economic activity; for M, the location must have a municipal outflow point.

9. (team) OWNS (location)

The economic decision-maker input as owning a parcel does not actually own that parcel.

10. BI TREATS OUTFLOW ONLY

There was a decision to build an intake treatment plant at a business. A basic industry can build an outflow plant only.

11. (land use) DOESN'T TREAT EFFLUENT

The economic activity on the parcel is not a basic industry, so it cannot treat its effluent.

12. OLD LEVEL IS NOT (level input)

The old level of treatment plant specified on the decision input does not match the plant's actual level.

13. COST TO (team) FOR WRBLD ON (location) IS $(amount), HAS ONLY $(amount)

The team does not have enough money to perform the construction.

14. TEAM MUST BE UTILITY

A team other than the Utility Department input a decision to locate an intake point, an outflow point, or a sampling station.

15. NO WATER ON (location)

There was an attempt to locate an intake or outflow point on a parcel which is not a lake or does not contain surface water.

$WRPRC

1. TEAM MUST BE UTILITY

A team other than a Utility Department used the $WRPRC code.

2. (land use) DOES NOT USE MUNICIPAL WATER

The land use for which the department attempted to set a price is a surface water user, a government department, or nothing. Prices can be set only for municipal water users.

OPERATING PROGRAMS OF THE CITY MODEL: 360 VERSION

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1. MIGRAT - main migration driver.

   HSDSST - calculate and stores dissatisfaction indices for all P1's on board.

   GETCUT - determines what personal dissatisfaction constitutes a 20% cutoff point for each class.

   MOOUT - determines how many P1's of each class on each residence working at each employment location will move out for reasons of 1) unemployment, 2) underemployment, 3) mobility, or 4) dissatisfaction.

   UNCRWD - calculates percent occupancy of each residence and determines how many P1's of each class on each residence must move out as a result of overcrowding.

   DISPLC - determines how many P1's of each class on each residence working at each employment location will move out in order to move out enough to satisfy UNCRWD's requirements.

   INMIG - determines how many immigrants will move in and how much population growth there will be.

   SETUP - determines where P1's will move into, using

      PICKRS - finds best available acceptable housing.

   MOIN - does actual moving in of P1's as determined by SETUP.

   JANOUT - prints migration detail.

   MIGSUM - prints migration summary.

KLEAR - tidies up after demolitions.

2 GAILMN - calculates water usage, pollution, water quality.

3. EDORD - orders Pl's of each class according to education level.

4. DEPREC - depreciates private developments, retaining what VR was after depreciation, then set VR to maintenance level if higher than VR.

5. ASVSET - determines assessed values of private properties depending on assessment input and land and building market value.

6. EMP - employment optimizer - determines full time employment locations for all Pl's - uses transportation.

7. TRTRC - full time employment transportation route trace - uses transportation to determine and print out employment transportation routes and costs.

TRTRC reiterates using

CONGES - determines road and rapid transit congestion after each iteration of TRTRC

8. EMPRT - part-time employment optimizer - uses transportation - prints part-time work allocation.

9. SETCAP - determines capacity of businesses based on employment and value ratio.

10. EMPSUM - prints out employment summary.

11. LOADMS - determines load on MS's - depreciates and renovates MS's.

12. MSQUAL - stores use index of MS serving each residence and business.

13. LOADSC - determines which Pl's will go to school outside system - determines load on schools - depreciates and renovates schools.

14. NSPACK - determines available and requested adult education - allocates time for adult education.

15. TMALC - determines allocation of time - how much time goes into involuntary - modifies voter registration in accordance with politics time and education level in accordance with adult education time - allocates Pl's to parks and determines park use indices.

16. ONAC - does construction contracts accounting - alters status of contracts based on CI capacities and transfers funds for contracts.

17. PRCSET - determines prices industries will get for output - determines maintenance costs for BG and BS - determines property taxes for businesses and residences.

18. SETCOM - determines commercial requirements for Pl's, businesses, and residences.

19. OPCM - commercial optimizer - uses transportation.

20. COMDIG - prints commercial diagnostics.

21. TERMS - terminal optimizer.

OUTPUT SECTIONS

22. PRYMAN - private output driver.

23. WRYOU - social output.

24. WRRES - residential.

25. WBUSS - business.

26. ECBOY - economic boycott.

27. LANDO - land summary.

28. CONIN - CI contracts.

29. FLSTA - financial statement.

30. LOSTA - loan statement.

31. UTS - utility.

32. PWS - municipal services.

33. PZ - planning and zoning.

34. SCHOUT - school.

35. HYWAY - highway

36. BSRROT - bus and rail.

37. CHO - chairman.

38. GOVMNT - government summary.

39. IDEMEC - summary statistics.

IX. FORMATS FOR LOADING A DATA BASE

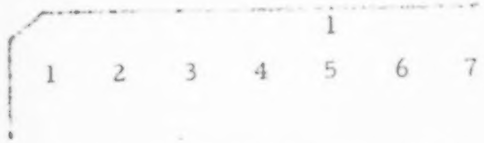
The load program sets up the initial data base for the model's data files. Various city configurations can be created with the initial data set-up. Specifying all the information required for a city description can be lengthy and involved. Particular attention should be paid to the order of the cards and the card field descriptions. The following points should be noted:

1. All data is right justified within a field. Data fills the extreme right hand column of a field and all necessary columns to the left. Any blank columns in a field will be to the left of the data.

Example:

Cols	Description
1-5	'1' if outflow point

Card



2. Card groups are numbered in the order they loaded. That order is the same as the order in which they are processed.

3. Where a card group is of variable length, a blank card ends the group.

4. When there is no information to enter for a card category, insert a blank card.

5. If no number or character is punched, the program will read that column as '0' (zero).

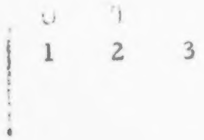
6. If there are no instructions for a column or columns, leave them blank.

7. When information in the load format description appears between apostrophes in a description, punch that specific information on the card.

Example:

Cols	Description
1-2	'UT'

Card



8. If a column number is followed by an asterisk (*) in the following format description, then the information in those columns for that Card Group cannot be changed after a data base has been loaded.

Card Group	Cols	Description
1 District Cards	1	Code for function being districted 1-jurisdiction* 4-utility 2-school 5-ward* 3-municipal service 6-river basin* 7-flood susceptibility
	9-10	District number for associated parcels
	11-18	Up to 7 pairs of diagonally opposite parcel locations which define a rectangle to be assigned that district number. Either pair of corners in any order may be given. If only one location is given, that parcel is assigned the district number.

**********Blank Card**********

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Card Group	Cols	Description
2 Number of Social Decision-Makers	1- 2*	Number of social decision-maker teams
3a Option Cards	*	(See "notes on the Load Program.)
3b Round Number & Headings	1- 5*	Round number (should start at 0)
	6-77	Game heading for print-out (any alpha-numeric characters)
4 Active Jurisdictions	1*	Put a 1 if jurisdiction 1 is in existence
	2*	Put a 1 if jurisdiction 2 is in existence
	3*	Put a 1 if jurisdiction 3 is in existence
5 Social Decision-Makers	1- 5 6-10	Pair of diagonally opposite parcel locations defining a rectangular area of control; Cols. 1-5 contain the upper left hand corner Cols. 6-10 [illegible]

Card Group	Cols	Descriptions
5 Social Decision-Makers	11-12	Team letter of social team controlling high income residents on the parcels
	13-14	Team letter of controlling team for middle income
	15-16	Team letter of controlling team for low income

**********Blank Card**********

6 Land Parcel Cards	1- 5	Parcel coordinate location
	7- 8	Team letter of owner
	10-11	Two-letter economic activity code (0=undeveloped)
	12-14	Constructed level of economic activity
	15-17	Zoning
	18-21	Value ratio or quality index
	22-25	Maintenance level
	30-33	Number of PH's residing on parcel
	34-36	Number of PM's residing on parcel
	37-39	Number of PL's residing on parcel There can be at most two income classes on a parcel. PH's and PL's may not be on the same parcel.
	40-43	Salary offered PH's/$100 if non-residential or rent per space unit if residential
	44-46	Salary offered PM's/$100 if non-residential or rent per space unit if residential
	47-49	Salary offered PL's/$100 if non-residential
	54-56	Level of utilities installed
	60-67	Price/CU in $100 if commercial establishment
	68-75	Assessed Value of land/$100,000 for 100 percent of parcel

Card Group	Cols	Descriptions
6 Land Parcel Cards	77-78	If basic industry on parcel, two-letter code for effluent treatment type
	80	Treatment plant level

**********Blank Card**********

7 Time Allocations	1- 2	Team letter of social decision-maker
	4	Social class (1-low; 2-middle; 3-high) Time allocation percents for:
	6- 8	Part-time work
	9-11	Public education
	12-14	Politics
	15-17	Recreation
	18-20	Pay Education

**********Blank Card**********

8 Utility Card:	1- 2	'UT'
	3	Jurisdiction number
	11-15	Parcel location of plant (0 if no plant, only undeveloped land)
	16-17	Level of plant (0 if no plant, only undeveloped land)
	18-20	Percent of parcel (developed plus undeveloped) owned by the Utility Department

Repeat format as in (11-20) for up to 6 more plants in cols. (21-30), (31-40), (41-50), (51-60), (61-70), (71-80). Use as many cards as required to designate all plants in all jurisdictions. NOTE: Utility land for only one jurisdiction can appear on a single card.

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Card Group	Cols.	Description
9 School Cards	1- 2	'SC'
	3	Jurisdiction number
	11-15	Parcel location of School
	16-17	Level of school (0 if no school, only undeveloped land)
	18-20	Percent owned by department (developed plus undeveloped)
	21-23	Value ratio
	24-26	Maintenance level
	27-29	Number of PM teachers requested (in Pl's)
	30-32	Number of PH teachers requested (in Pl's)

Repeat format as in (11-32) for up to 2 more schools in Cols. (33-54) and (55-76). NOTE: School land for only one jurisdiction can appear on a single card.

**********Blank Card**********

10 Terminal Cards	1- 2	'TM'
	3	jurisdiction
	11-15	intersection coordinate
	16-17	level of terminal
	18-20	Percent of land used by terminal on each of the four parcels surrounding the intersection

Repeat format as in (11-20) for up to 6 more terminals in Cols. (21-30), (31-40).....(71-80).

**********Blank Card**********

11 Park and Public Institutional Land	1- 2	'PZ' or 'PI'
	3	jurisdiction
	11-15	parcel containing parkland
	16-20	Percent of land in park or public institutional use.

Repeat format as in (11-20) for up to 6 more parcels in Cols. (21-30)... (71-80). Land for park use and land for public institutional use cannot be included on the same card. Park or PI land for only one jurisdiction can appear on a single card.

Card Group	Cols.	Descriptions
12 Municipal Services	1- 2	'MS'
	3	jurisdiction
	11-15	parcel location of plant
	16-17	level of plant (0 if no MS, only undeveloped land)
	18-20	Percent of land owned by department (developed plus undeveloped)
	21-23	value ratio
	24-26	maintenance level
	27-29	number of PL workers requested (in Pl's)
	30-32	number of PM workers requested (in Pl's)

Repeat format as in (11-32) for up to 2 more plants in cols. (33-54) and (55-76). NOTE: MS land for only one jurisdiction can appear on a single card.

*********Blank Card*********

Only one of the two following road card formats may be used in a single load deck. Which of the two is to be used is determined by the Option Card (Card Group 3a) for road formats. The first format allows road value ratios to be different for individual road segments. The second does not have this provision for differentiation but simplifies the coding and punching required for loading roads.

13a Road Cards	1- 2	'RD'
	3	jurisdiction
	11-15	intersection where road segment begins
	16	direction of road segment (E for east or S for south)
	19	road type
	23-25	value ratio of road segment

Repeat format as in (11-25) for up to 3 more road segments in cols. (26-40), (41-55), and (56-70). NOTE: Roads in only one jurisdiction can appear on a single card.

13b Road Cards	1- 2	two-digit row number of intersection
	3	blank
	4	for intersection of column 69 with row, road type going south

Card Group	Cols.	Description
13b Road Cards	5	For same intersection, road type going east

Repeat as in cols. (3-5) for each intersection in the row in order of left to right across the board.

For each intersection in row, whether or not roads emanate from the intersection, use three digits; first digit blank, second with road type going south, third with road type going east. For example, intersection of column 71 with a row has column 6 blank and road types in 7 and 8. Intersection with 73 uses columns 9-11. Intersection with 75 uses columns 12-14. There are 25 columns of intersections, or 75 card columns required (col. 3 to col. 77).

A road on a jurisdiction boundary is assigned to the lower-number jurisdiction. The road value ratios are set to the maintenance levels specified in Card Group 32.

**********Blank Card**********

14 Undeveloped Highway Land	1- 2	'HY'
	3	jurisdiction
	11-15	parcel location
	16-20	Percent of land owned but undeveloped

Repeat format as in (11-20) for up to 6 more parcels in cols. (21-30), (31-40)....(71-80). NOTE: Undeveloped Highway land for only one jurisdiction can appear on a single card.

**********Blank Card**********

15 Team Cash (one for each economic team)	1- 2*	team letter
	11-20	previous cash balance/$1000
	21-30	number of loans for which this team is the borrower
	31-40	dollar value of time for PH
	41-50	dollar value of time for PM
	51-60	dollar value of time for PL
	61-70	cash balance

(A team's loan cards follow each team cash card if there are any loans outstanding. One loan per card.)

Card Group	Cols.	Description
Loans	1-3*	team letter of team lending (OU for outside)
	4-6*	remaining term
	7-9*	interest rate in mils (.1 percent)
	10*	'0' if loan was originally short term (2 rounds) or '1' if the loan was originally long term (25 rounds)
	11-20*	amount of loan/$10,000

*********Blank Card*********

Card Group	Cols.	Description
16 Municipal Services Salaries	1-5	salary offered a low-income worker (in $100's) in jurisdiction 1
	6-10	salary offered a middle-income worker (in $100's) in jurisdiction 1

Repeat as in (1-10) for jurisdictions 2 and 3 in cols. (11-20) and (21-30) respectively.

Card Group	Cols.	Description
17 School Salaries	1-5	salary offered a middle-income worker (in $100's) in jurisdiction 1
	6-10	salary offered a high-income worker (in $100's) in jurisdiction 1
	11-15	middle-class part-time units requested in jurisdiction 1 for adult education employment
	16-20	high-class part-time units requested in jurisdiction 1 for adult education employment

Repeat as in (1-20) for jurisdiction 2 and 3 in cols. (21-40) and (41-60) respectively.

Card Group	Cols.	Description
18 Bus Salaries	1-5	salary offered by bus company/$100
	6-1	salary offered by rail company/$100
19 Bonds	1-2*	department name (HY, UT, MS, SC, PZ, BU, RR)
	3*	jurisdiction (1, 2 or 3) - blank if BU or RR
	4-5*	interest rate in 1/10 percent
	6-7*	remaining term
	8*	"0" if current bond (originally 2 year term) "1" if capital bond (originally 25 year term)
	9-14*	amount of bond/$10,000

Card Group	Cols.	Description

Repeat as in cols. (1-15) for up to 5 bonds in cols. (16-30), (31-45), (45-60), (61-75). Use as many cards as necessary.

********** Blank Card **********

Card Group	Cols.	Description
20 Taxes, Land Bid and Outside Construction Charges	1	jurisdiction
	2-6	land tax rate
	7-11	building tax rate
	12-16	resident income tax
	17-21	employee income tax
	22-26	resident auto tax
	27-31	employee auto tax
	32-36	personal goods tax
	37-41	personal services tax
	42-46*	percent of bid price charged for land bid
	47-51*	percent above value for outside construction if local CI is being used (See Option Cards, Card Group 3a)

Note: All rates are in .1 percent's

Note: The last two items on this card should appear on one card only, since those parameters do not vary by jurisdiction.

********** Blank Card **********

Card Group	Cols.	Description
1 Assessment Ratio		blank

2 Appropriations

Must be in the order of HY, UT, MS, SC, and PZ, BU, and RR. 1 card per department type. Although UT, BU, and RR cannot receive appropriations, their cards must be included, e.g., UT followed by 78 blanks

Card Group	Cols.	Description
	1-2	department (HY, UT, MS, SC, PZ, BU, RR)
	3-12	current appropriation-Jurisdiction 1
	13-22	capital appropriation-Jurisdiction 1

Repeat in (23-42), (43-62) as in (3-22) for Jurisdictions 2 and 3.

Card Group	Cols.	Description
23 Rents (8 residences per card)	1-5	location
	6-10	rent per space unit

Repeat in (11-20), (21-30), (31-40), (41-50), (51-60), (61-70), (71-80), as in (1-10) for up to 7 more parcels per card.

***********BLANK CARD***********

24 Bus Routes (one card for each route's general information and after it, one or more cards for detailed stop and turn information for that route)

	1-3	level of service
	5	"1" for Bus
	6-10	route number
	11-15	number of turns (exclusive of start and end points of route)
(detailed route information)		
	1-5	starting point of route
	6-10	location of turn or end point

Repeat in (11-15), (16-20), (21-25) . . . . . (76-80) as in (6-10) until end of route.

********** Blank Card **********

25 Rail Stations	1-5	'RLSTA'
	6-10	number of stations on the board
	11-15*	intersection where rail station is located

Repeat in cols. (16-20), (21-25) . . . (76-80) and also on additional cards from (11-15) if needed for all the stations.

********** Blank Card **********

26 Unused Rail Land	1-5	'RLLND'
	6-10	twice the number of parcels on this card
	11-15	parcel location
	16-20	percent of land owned by RR department but unused

Repeat in (21-30), (31-40) . . . (71-80) and on additional cards from (11-20) for as many parcels as needed.

********** Blank Card **********

Card Groups	Cols.	Descriptions
27 Track Segments	1-5	'RLTRK'
	6-10* 11-15*	intersection pair which defines track segment
	16-20	location of parcel over which any part of track segment is above ground

Repeat as in (16-20) in (21-25) up to (71-75) for up to 11 more parcels. Use as many cards as is necessary to indicate all track segments. Use one card per track segment.

********** Blank Card **********

28 Rail Routes (one card for each route's general information plus one or more cards for detailed stop and turn information for that route)

	1-3	level of service
	5	'0' for rail
	6-10	route number
	11-15	number of turns and/or stops including start and end points
	(additional cards for each route)	
	1-5	intersection of stop and/or turn
	10	0 - if stop or stop and turn 1 - if turn only

Repeat in (11-20), (21-30) . . . (71-80) until last stop.

********** Blank Card **********

29 BG/BS Contracts -- (2-7 cards per department)

Card 1	1-2	department ('MS' or 'SC')
	3	jurisdiction of department
	4-8	number of contracts (up to 6)

Card 2 - 7 (up to 6 contracts, a maximum of 3 for BG and 3 for BS per department)

	1-2	"BG" for BG contracts
	6-7	"BS" for BS contracts
	12	team owning BG or BS
	13-17	location of BG or BS facility
	18-20	percent of total business to be given to this establishment

********** Blank Card **********

Card Group	Cols.	Description
30 Boycotts (economic or social)		
	1-2	team boycotting
	3	land use boycotting
	4	class boycotting (1-low, 2-middle, 3-high)
	5	function boycotted (0-shopping, 1-employment)
	6-10	location boycotted

Either class or land use should be given; not both.

********* Blank Card *********

31 Bus/Rail Fares	5	1-for rail; 2-for bus base fare
	6-10	base fare in cents
	16-20	fare increment per mile
	21-25	value ratio of equipment
	26-30	maintenance level of equipment

********* Blank Card *********

32 Highway Maintenance Levels	1-5	maintenance level road type 1 Jurisdiction 1
	6-10	maintenance level road type 2 Jurisdiction 1
	11-15	maintenance level road type 3 Jurisdiction 1

Repeat in cols. (16-30) and (31-45) for jurisdictions 2 and 3 respectively.

33 Education Level (1 card per residence)		
	1-5	parcel location
	6-8	education level - high class on parcel
	9-11	education level - middle class on parcel
	12-14	education level - low class on parcel

********* Blank Card *********

Card Groups	Cols.	Descriptions
34 Welfare Payment	1	jurisdiction (1, 2, or 3)
	2-6	welfare payment per unemployed worker (in $100's)

********* Blank Card *********

35 Prices for Outside Purchases	1-10*	price per CU for Outside PG or PS (in 100's)
	11-20*	price per CU for Outside BG or BS (in 100's)
	21-30*	price per MG for Outside water (in 100's)
	31-40*	price per MG. for Outside water for residences with private utilities
36 Topographical Restrictions and Preempt Land	(input by rows)	
	1-2	row number (12-60)
	(6-8) up to (78-80)	3 columns per board square for given row (coordinate numbers: 70-118) containing percent of square which is undevelopable.

********* Blank Card *********

37 Government Employment Locations	1-10	Rail employment location

Repeat format as in (1-10) in cols. (11-80) in order of BUS, MS1, SC1, MS2, SC2, MS3, SC3.

38 Federal-State Employers	1-5	location
	6-10	number of low-income P1 job openings
	11-15	number of middle-income P1 job openings
	16-20	number of high-income P1 job openings
	21-25	salary offered low-income worker/100
	26-30	salary offered middle-income worker/100
	31-35	salary offered high-income worker/100

1 card per location

********* Blank Card *********

Card Group	Cols.	Description
39 Surface Water Parcel Cards	1-5*	location
	6-10*	volume in MGD
	11-13*	percent of land area consumed
	14-15*	rate of flow in parcels per day
	16-20*	location that water flows into (next parcel)

Repeat format as in columns 1-20 for up to three more parcels.

********** Blank Card **********

40 Lake Parcels	1-5*	location
	6-10	water quality rating

Repeat format as in cols. 1-10 for up to 7 more parcels.

********** Blank Card **********

41 Individual Farms	1-2*	code number of farm
	4*	owner (alphabetic code)
	5-6*	farm type (1-11)
	8	fertilizer facter (0-3)
	10-14*	normal (when fertilizer factor is 0) net income before taxes per 1 percent in farm (in $100's)

Repeat as in columns 1-15 for up to 4 more farms.

********** Blank Card **********

42 Individual Farm Parcels	1-2*	code number of farm
	4-8*	parcel location
	13-18	assessed value of farmland on parcel (in $100,000's)
	20-24*	parcel on which farm parcel dumps
	26-29*	volume of water (in MGD) dumped by farmland on parcel

Repeat as in columns 1-40 for one more farm parcel in columns 41-80.

********** Blank Card **********

Card Group	Cols.	Description
43 Farm Types -- Normal Income	1-2*	code number of farm type (1-11)
	3-5*	multiplier on normal income per percent in farm for fertilizer factor 1 (in percents)
	6-10*	same for fertilizer factor 2
	11-15*	same for fertilizer factor 3
	16-20*	parts per million nutrients dumped at fertilizer factor 0
	21-25*	same for fertilizer factor 1
	26-30*	same for fertilizer factor 2
	30-35*	same for fertilizer factor 3

1 card per farm type

********* Blank Card *********

Card Group	Cols.	Description
44 Municipal Treatment Plants	1-5	location
	7-8	two-letter code for treatment code (for outflow only)
	9	level of treatment plant
	10	0 if intake treatment, 1 if outflow treatment

Repeat format as in cols. 1-10 for up to 7 more treatment plants.

********* Blank Card *********

Card Group	Cols.	Description
45 Intake and Outflow Points	1-5	point location
	6-10	location of UT plant serving district
	15	0 if intake, 1 if outflow

Repeat format as in columns 1-20 for up to 3 more points

********* Blank Card *********

Card Group	Cols.	Description
46 Sampling Stations	1-5	location (if M, location of UT district which uses dumping point

Card Group	Cols.	Description
	6	P = business point source A = ambient M = municipal point source E = all three kinds everywhere on the board (no location is given in cols. 1-5 in this case)

Repeat format as in columns 1-6 for up to 12 more stations

Note: For a municipal point source sampling station the location given should be that of the parcel on which its outflow point is located.

********** Blank Card **********

Card Group	Cols.	Description
47 Water Prices	1-2	jurisdiction
	4-5	two-letter code for activity type (AL for all and it supercedes any prices in the jurisdiction input before it but does not apply to any following). Prices can vary by class by residence type. The first letter is the class (H, M, or L) and the second letter is the residence type (A, B, or C).
	6	blank
	7-10	price per MG

Repeat format as in cols. 4-10 for up to 10 more activities in the jurisdiction

********** Blank Card **********

Card Group	Cols.	Description
48 Typical Rents and Salaries	1-5*	typical rent per space unit for low-income Pl (in $1,000's)
	6-10*	same for middle-income Pl
	11-15*	same for high-income Pl
	16-20*	typical salary per low-income worker (in 100's)
	21-25*	same for middle-income worker
	26-30*	same for high-income worker
49 Dam Priority Effects	1-2*	code number of river basin
	3	priority (A, B, or C)
	4-5*	Major Recreation multiplier on consumption for dam Priority A (in tenths)
	7-8*	same for dam priority B
	10-11*	same for dam priority C
	13-14*	flood severity multiplier for dam priority A (in tenths)
	16-17*	same for dam priority B

Card Group	Cols.	Description
	19-20*	same for dam priority C
	22*	number of water quality levels to be subtracted from surface water quality rating for dam priority A
	24*	same for dam priority B
	26*	same for dam priority C
	31-35*	location of dam in river basin

Repeat as in columns 31-35 in cols. 36-40, 41-45, etc., for location of each dam in river basin

1 card per river basin

********** Blank Card **********

50 Major Recreation Areas	1-5*	parcel location
	7*	1, if the major recreation area is affected by dam priorities in its river basin
	6-10*	percent of parcel in major recreation
	11-15*	PG units consumed at water quality 1-3
	16-20*	PS units consumed at water quality 1-3
	21-25*	PG units consumed at water quality 4
	26-30*	PS units consumed at water quality 4
	31-35*	PG units consumed at water quality 5
	36-40*	PS units consumed at water quality 5
	41-45*	PG units consumed at water quality 6-9
	46-50*	PS units consumed at water quality 6-9

1 card per major recreation area

********** Blank Card **********

51 Economic and Social Histories

This Card Group consists of two sections, each of which has a single card identifying the section, followed by cards containing information regarding previous years.

Card Group	Cols.	Description
Card one:	1-4	'HIST'
	5-80	blank
Followed by:		
1 card per economic team, in alphabetical order by team.		
	1-4	average rate of return on developments for year t-4 (in tenths of percents)
	5-8	same for t-3
	9-12	same for t-2
	13-16	same for t-1
	20-23	net worth (in millions of dollars) in year t-4
	24-27	same for t-3
	28-31	same for t-2
	32-35	same for t-1
Card one:		
	1-6	'SOCIAL'
Followed by:		
One pair of cards per social team, in alphabetical order by team.		
first card in pair:		
	1-3	average quality of life index for low-income class in year t-4
	4-6	same for t-3
	7-9	same for t-2
	10-12	same for t-1
	13-15	average quality of life index for middle-income class in year t-4
	16-18	same for t-3
	19-21	same for t-2
	22-24	same for t-1
	25-27	average quality of life index for high-income class in year t-4
	28-30	same for year t-3
	31-33	same for year t-2
	34-36	same for year t-1

Card Group	Cols.	Description
second card in pair:		
	1-5	average salary earned by low-income workers in year t-4
	6-10	same for t-3
	11-15	same for t-2
	16-20	same for t-1
	21-25	average salary earned by middle-income workers in year t-4
	26-30	same for t-3
	31-35	same for t-2
	36-40	same for t-1
	41-45	average salary earned by high-income workers in year t-4
	46-50	same for t-3
	51-55	same for t-2
	56-60	same for t-1

X. Notes on the Load Program

The City IV load program will load data bases configured for the following models:

City II (1108 Version)
City III (1108 Version)
City III (360 Version)
City IV (360 version without water system)
City IV (360 version with water system)

The flexibility of the load program allows the user to load previously developed data bases into the same operating model for which new data bases may be configured.

The model user should be extremely careful when loading a new data base into the model. Whereas the edit program which handles player inputs has many checks against errors, both coding and substantive, the load program makes very few checks on the data submitted to it: it merely allocates the data to the appropriate files for storage according to the card columns and groups in which the data appear. The coding, card punching, design processes and design intentions should be rechecked several times before a data base is loaded. Failure to do so almost always results in many wasted man-hours and much wasted expensive computer time. Even when a data base is completely accepted by the LOAD program, many errors may appear in the first round of output as a result of loaded data errors.

- If the load program blows off the system, there is an error in the data cards. All cards should be rechecked.
- Whenever the load program indicates a data error (which it is programmed to detect for very few data items), the data card should be fixed before the load program is executed again.
- If an error appears in Round 1 output, the loaded data should be checked for errors and omissions.

There are only two types of data errors which do not have significant effects on the rest of the model, and the load program does note when these occur. The first occurs when an economic activity is loaded on a parcel which has less utility service installed than the activity requires in order to operate. If the error is not corrected, the activity will still pay for the full amount of utility service which it requires, and the Utility Department will receive the full revenue. However, the level of utility service on the parcel remains at its loaded value until changed by a Utility Department input.

The second type of data error occurs when the various land uses on a parcel consume more than 100% of the land on the parcel. Before any land uses are processed by the load program (i.e., before Card Group 6 is processed), the amount of land on each parcel is set to 100%. As each type of land consumer is processed, the appropriate amount of land is subtracted from the running total of the parcel's remaining land. If, when the program attempts to decrement that running total, a parcel would have less than zero remaining land, the program prints a message to that effect, and does not decrement the running total, but does register the land use as existing on the parcel. The land use is handled as usual, except that it does not decrease the remaining land on the parcel. In effect, a parcel can be more than 100% used. If a card from card groups 8, 9, or 12, indicates a land requirement greater than the remaining land on a parcel, any undeveloped land appearing on the card is not registered. Only actual land uses can cause a parcel to be more than 100% used. When the program encounters a land error, it prints:

```
NEGATIVE LAND ATTEMPT AT LOCATION - AMOUNT NEEDED - AMOUNT AVAILABLE
```

As data is fed to the load program and processed, the program prints output indicating what errors it does detect and, in most cases, prints the information which was on the data card. In the following notes concerning the load program, the program checks on the data are noted as well as the form of the printed output which the program produces for each Card Group. Ramifications of some data errors are traced.

The listing which follows these notes are the data loaded for RAYWID, a large three-jurisdiction data base of 2,500,000 population, and TWOCITY, a two-jurisdiction data base of 300,000 population. RAYWID was developed new for the water model; TWOCITY is a modification of a data base originally developed for the 1108 version.

In order for the listing to fit on standard-size paper, card columns 73-76 have been deleted, leaving columns 1-72 and 77-80. The listing is intended to be used as an example of a complete load deck, and the missing columns are not essential to the example.

Superimposed on the listing is notation which groups cards belonging to the same Card Group. The Card Group number is also noted.

Card Group   Notes

1   If a number greater than 7 appears in column 1, the program prints: INVALID DISTRICT TYPE NUMBER. The RAYWID example contains considerably more pairs of coordinates than are actually required for the definition of the various districts. Note that when one card does not have enough room for complete specification of a district, more cards may be used.

3a   This section of the load deck allows the director to specify how data is being loaded and to determine what model will be run on the data base. These are the Option Cards. It is not a required Card Group, so no blank card is necessary if no director option cards are loaded.

Use one card per option. They may be loaded in any order. The option code words should begin in column 6, and the remainde of the card to the right of the option code word should be blan Some option cards contain information to the left of column 6.

1. WATER

This code indicates that the water-related data, card groups 39-50 are being loaded. If this card is not used, the load program assumes that water is not being included in the model, and the water phase of the model does not run. The water-related maps do not print and Migration has a different output format from the example shown in the Player's Manual.

2. NOCI

This specifies that the NOCI option is in effect. There must be no CI's loaded. All construction is done by the Outside with no round lag. If this card is not used, construction has a 1-year lag and CI's may be built or loaded.

3. RDLENG

Columns 1-5 should contain, right justified, the length of the side of a parcel in 100ths of a mile. If the number there is greater than 200, the rest of the programs use the water model land requirements. If the length is less than 200, the industries use the HI and LI land requirements and all land uses have City 3 land requirements.

4. NEWFMT

This indicates that land is specified in 1% units. If NEWFMT is not given, land is assumed to be in 4% units. This is significant for Card Groups 8, 9, 10, 11, 12, 14

Card Group   Notes

and 26, where land amounts are coded in 25ths of parcels in the 1108 version. NEWFMT also indicates that Card Group 35, Outside Prices, has the format shown for it in "Formats for Loading a Data Base". If NEWFMT is not given, the format shown in the "Notes On the Load Program" for Card Group 35 must be used.

5. NEWROAD

This indicates that the road format in Card Group 13b is being used to load roads. If NEWROAD is not used, 13a is assumed to be the road format.

6. LOTRV

Columns 1-5 should contain, right justified, the maximum percent of the salary offered at a job location which a low-income worker will pay in order to get to the job. This percentage is used when a list of potential employment locations is created for a worker. If LOTRV is not used, the percentage is assumed to be 25.

7. MIDDTRV

This is the same as LOTRV except that it applies to middle-income workers. If MIDDTRV is not used, the percentage is assumed to be 20.

8. HIGHTRV

This is the same as LOTRV except that it applies to high-income workers. If HIGHTRV is not used, the percentage is assumed to be 15.

The standard option cards used in City IV with water are:

bbbbbWATER
bbbbbNOCI
bb250RDLENG
bbbbbNEWFMT
bbbbbNEWROAD

In the RAYWID example, NOCI does not appear as a loaded option card. It must be input to the Round 0 or Round 1 data base. In TWOCITY, the land is input in 4% units, since TWOCITY was originally developed for the 1108 version. Roads are in card group 13a format.

3b   There are two reasons that the round number should start at zero. The round number is updated in CITY4. Before that point, two programs check the round number as a basis

Card Group	Notes
	for deciding whether to execute. One, migration, does not run if the round number is zero. Round 1 output thus has the same population as is loaded into the data base. The other program runs only if the round number is zero. It sets the utility price per unit to $10,000 in each jurisdiction. Note that utility prices are not loaded. Neither can they be input to the Round 0 data base, since when CITY4 is executed to produce Round 1 output, all utility prices are set to $10,000.
4	A new jurisdiction cannot be created after the load program has been executed. This card group indicates to the print programs how many jurisdictions to print output for.
5	Team number (1=A, 2=B, etc.) is used instead of team letter in data bases originally developed for use in the City II and City III 1108 versions. Either team letter or team number may be use here. Note that in TWOCITY, the last three cards in this Card Group repeat parcel locations for which social control has already been allocated on previous cards. Control was reallocated after the data base was first loaded, and rather than change several cards, the new data was loaded over the old. The last card entered for a parcel is the one that counts.
6	Data bases developed for the 1108 version: team number is in columns 7-8; column 10 is a one-digit land-use code (0=undeveloped, 1=residence, 2=LI, 3=HI, 4=NS, 5=CI, 6=BG, 7=BS, 8=PG, 9=PS); column 11 is residence type (A, B or C). Team number is used for all team designations in the data bases originally developed for the 1108 version. The TWOCITY example contains both 1108 and 360 formats for this Card Group. Land parcel cards need be loaded only for parcels which have local system economic owners. Parcels which do not have local owners are automatically assigned to the Outside as owner. The only check on this card group is for valid parcel coordinates. A card having invalid coordinates is entirely rejected. The level of economic activity given in columns 12-14 assumed to be its constructed level. If the director wishes to start an activity with a lower operating level, he should make that input to the Round 0 data base created after the load program is executed.

Card Group Notes

Columns 40-43 (rent per space unit if non-residential) do not require rents. Rents can be loaded in Card Group 23. Any rents appearing in that card group override rents appearing in Card Group 6. If all rents are in Card Group 6, Card Group 23 should contain only a blank card.

The data bases originally developed for 1108 versions of the model have all rents in Card Group 23.

For any parcel which is loaded as having no economic team owning it (including OU as an economic team) i.e., all land is either undevelopable or owned by the government, an assessed value should be given to it in the card group, even though the parcel card will show no economic owner.

7 If columns 9-11 are non-zero for PH, the program sets them to zero but does not print a message to that effect. High-income cannot allocate time to free education. There is no check that low-income does not allocate time to pay education.

There is no way to separate the time allocations of people controlled by the same team and of the same class but living in different jurisdictions. To make such a distinction before the beginning of a game, the director should input new time allocations to the Round 0 data base.

If time allocations are not loaded for a class on a parcel, those PL's take the time allocations of inmigrants of their class. The time allocations of inmigrants are:

	PL	PM	PH
Extra Job	40	30	20
Free education	20	30	0
Pay education	0	5	20
Politics	10	20	40
Recreation	20	10	10

8, 9, 10, 11 12, 13a, 14 Special care should be taken to make sure that the parcels designated as being owned by these departments are in fact located within the jurisdictions to which they are assigned by these cards. An error here can lead to many other types of problems and contradictions when the model is run.

8, 9, 10, 12, 13 After the utility cards (Card Group 8) have been processed, the program prints a table showing some information about what was on the cards. The table has the following headings: LOC (location of parcel), LVL (level of development of the utility plant there), LND (total amount of land owned by the Utility Department there in 1% units), SQ (the internal program coordinates of the parcel), LDN/UT (amount of land on the parcel which is developed in utility plants)

Card Group	Notes
	TTL CTV (a column which is always blank). The same format is used for Card Groups 9 and 12. For Card Group 10 (terminals), there is one row for each parcel from which a terminal takes land. For Card Group 12 (roads), DIR (direction, E for east or S for south) is given instead of LVL. There is one row for both parcels from which a road segment consumes land. The program also prints the number of cards submitted in each of these Card Groups.
10	If columns 18-20 do not contain the correct amount of land for the type of terminal being loaded, the terminal is rejected.
13	It is generally wise not to load roads all over the board or even on half of the roadbeds, since the transportation programs consider all possible routes between parcels and will run for extreme lengths of time if presented with a myriad of alternatives.
15	The program makes no checks on and prints no error messages for this Card Group. It merely prints the cards as they are processed. The cards must be in alphabetical order by team. The only economic teams ever recognized by the program for a game using a particular data base are those initially designated as in existence by Card Group 15 during LOAD. If the director wishes to allow for the creation of new economic sector teams during a game, those teams must be included in this card group. For example, the director might want to allow for the social sector's development of their own housing complexes, industries, or investment in Outside businesses (stocks). Such social action would have to be done through an economic team. The director could, by designating a few extra economic teams in this card group, give the social sector those extra economic decision-maker codes. Cash balances need not be loaded; a team letter is sufficient here to create an economic team. The social sector's initial dollar value of time is also loaded in this card group, although there may be more or fewer social than economic teams. The social teams allowed are designated in Card Group 2 and Card Group 5. Card group 2 gives the number of social teams, but Card Group 5 allocates geographic control to those teams. If seven social teams are specified in Card Group 2 but only six are given control in Card Group 5, then only six social teams can ever control Pl's. If there are to be more social than economic teams,

Card Group	Notes
	then Card Group 15 should contain at least as many team cards as there are social teams, or else those social teams which are not included here have a dollar value of time of zero. Of course, the director can input dollar values to the Round 0 data base.
18	If water is being used in the model, no card should be included for Card Group 18. No blank card should be used either. If the director wishes to include Bus or Rail in the water model, he must input their salary offers to the Round 0 data base.
19	The only check on this Card Group is on whether there is an invalid department name given on the data card. The program prints the following message if there is an invalid name: ILLEGAL DEPARTMENT
21	At one time during the model's development, assessment ratios were loaded, but now they are set by the LOAD program. The blank card is necessary here, however. The director can change the initial assessment ratios for the game by an input to the Round 0 data base.
22	There is no program check that the departments which can receive appropriations are the only ones given appropriations. If Utilities, Bus, or Rail are given appropriations during LOAD, they will continue to receive appropriations throughout the game, although the appropriations will never appear itemized as such on those departments' output. There is no way to cancel a Utility, Bus, or Rail appropriation through EDIT. If Planning and Zoning receives a current appropriation in the load phase, it will never be able to spend that money, since the input (edit) program does not acknowledge a current account for Planning and Zoning. However, the Chairman will spend the amount of the appropriation every round.
23	See note for Card Group 6, columns 40-43. If Card Group 23 has some rents, and if there are more than one jurisdiction (as indicated by Card Group 4), then the rents in Card Group 23 are set to 92% of the value punched on the data card. When a two-jurisdiction data base was first loaded into the model, all of the rents were too high. Rather than change all of the rent cards, we changed the program to lower the rents loaded. Card Group 6 is never affected by the number of jurisdictions. If a rent is specified here for a parcel which does not contain a residence, there is no error message but the rent is ignored by the program. RAYWID has all rents in Card Group 6; TWOCITY has all rents in Card Group 23.

Card Group	Notes
24	The program makes two checks: 1) that the coordinates specified are in fact valid intersection coordinates, and 2) that all portions of a route travel along roads.
25, 27	The only program check here is that the intersection coordinates are valid.
28	This Card Group should be coded very carefully because the program does not check that there are stations or track segments where routes are specified.
29	The program makes three types of checks on the data: 1) that the department having the contract is SC or MS; 2) that no more than three BG or three BS contracts are granted to a single department; 3) that the type of contract specified is with BG (cols. 1-2) or BS (cols. 3-7).
30	If on the same boycott card both a land use (col. 3) and a class (col. 4) are specified as boycotting, the program rejects the boycott and prints: INCONSISTENT BOYCOTT Note that a use (of bus or rail) boycott cannot be loaded. If the director wishes to start the game with a use boycott in effect, he must input the boycott to the Round 0 data base.
32	If the road format of Card Group 13b is used, then the road value ratios are set to the maintenance levels specified here. If no mainterance level is specified here, the value ratios are set to 100, but the maintenance levels are 0. If the road format of Card Group 13a is used, then the value ratio of any road for which a value ratio is not specified in that Card Group is set to the maintenance level specified here. If no maintenance level is specified here, the value ratio of such a road is set to 100.
33	If the coordinates of the parcel are invalid or if the designated parcel does not contain a residence, the program rejects the data card and prints: ILLEGAL LOCATION If educational levels are not loaded for a class on a parcel, those Pl's have the educational levels of inmigrants of their class (PL-15; PM-55; PH-85).
35	If the NEWFMT option is not used (se notes on Card Group 3a), then columns 1-4 should contain 'P/CU' and all other information on the card should be shifted four columns to the right.

Card Group	Notes
	After this Card Group is processed, the program checks that all economic activities have sufficient utility service and that all parcels having utility service are in utility districts Any discrepancies are noted by printed messages, although the program does not reject or modify discrepancies.
36	Lake parcels should be included as parcels entirely topographically restricted, since there is no check in $ BUILD to prevent construction on a lake parcel.
37, 38	The only checks are that the coordinates are valid. If a surface water parcel dumps on a parcel that does not have surface water, the program prints: PARCEL DUMPS ON NON-RIVER PARCEL.
40	The program checks that the parcel coordinates are valid and that the water quality is valid (1-9). A parcel which is a lake parcel cannot have any land use on it.
42	The program checks that the farm parcel's code number matches a farm code number loaded in Card Group 41.
44	The program checks that the coordinates are valid, that the two-letter treatment type code is valid, that column 10 contains only 0 or 1, and that the treatment plant is in a utility district. If a treatment plant of the same type has already been loaded for the utility district, (intake or outflow) the program takes the latest plant, erases its record of the previously-loaded plant, and prints a message that it has done so. Note that in the sample data decks intake treatment plants have two-letter type codes. Those codes are ignored by the program in the case of intake treatment plants, which do not have type codes.
45	The program checks that the point location has water, that there is a utility plant at the location specified in columns 6-10, and that column 15 contains 0 or 1.
47	The program checks that the two-letter activity type code is valid.
49	The program checks that the dam priority is only A, B, or C and that there is surface water on each parcel designated as having a dam. If no dam priority values are loaded for a river basin, all of the multipliers are assumed to be 1.0 and the water quality effect is 0, even if a dam is loaded in the river basin.
51	Any columns to the right of those specifically designated as data fields are ignored by the program. In the RAYWID and TWO CITY examples, the letter of the team for which the data applies is punched on each card.

Card Groups	Notes
	If the 'HIST' section is omitted from the load deck, the program does not attempt to process any cards for 'SOCIAL'.

XI. EXAMPLES OF LOAD DECKS: RAYWID AND TWOCITY

```
          DECEMBER 1971                                   ** RAYWID   **
#1
1        1 8438 9440 8028 8636 8826 9236 9426 9836 9824 98241002810236
1  JUR.  2 962810240 864210244 764610248 725010256 945810060
1        3116121185611214114561081611056106181061810420106561022210222100226
2        1102221022210420114221061810618108161181811214112141141411414111814
2        21002410626
2        3116201182210824118261042811036
2        4 9426 9426 9626 9626
2        5 9630 9630 9632 9632
2        6 9430 9430
2        7 8828 9230 9428 9428 9232 9232
2        8 8632 8632 8832 8832
2        9 8028 8630 8032 8436 8438 8438 8440 8440
2   SC  10 9032 9032 8634 9236 9638 9440
2       11 9432 9432 9434 9636 983210236
2       12 9628 9628 982810230
2       13 9824 9824 9826 9826
2       14 8042 9044 7646 9048 7250 9056
2       15 965010052
2       16 9654 9654 9854 98541005410054
2       17 963810240 984210248 1025010250
2       18 9250 9456 9458 9458 9460 9460
2       19102521025210254102541025610256 965610060
2       201043811856
3        1 8028 8630
3        2 8826 9028 9226 6226
3        3 9426 9426 9626 9626
3        4 9824 9824 9826 9826 9628 9628 9828 982810028100281022810228
3        5 8032 8436 8636 8636 8438 8640
3        6 8830 8830 9030 9030 8632 8632 8832 8832
3        7 9228 9228 9230 9230 9232 9232
3        8 9428 9428 9430 9430
3        9 9630 9630 9632 9632
3       10 9830 983010030100301023010230
3       11 9032 9032 8634 8634 8834 8834 9034 9034
3       12 9432 9432 9234 9234 9434 9434
3   HS  13 983210236 9634 9634 9636 9636
3       14 8836 9440
3       15 8042 9056 7646 7856 7250 7456
3       16 963810248 9242 9448
3       17 9250 9454 9254 9256
3       18 9650 9650 9850 985010050100501005210052
3       1910250102501025210252102541025410256 10256
3       20 9652 9652 9852 9852 9654 9654
3       21 9854 98541005410054
3       22 945610060
3       231161211818112141141810816110181061810618
3       24104201142210222102221002410626
3       2511620118361082411436104281 0636
3       261043811856
4        1 8828 8826 9028 9026 9228 9228 9426 9426 9428 9428 9626 9626
```

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```
       DECEMBER 1971                                   ** RAYWID   **
4         2 8632 8632 8830 8830 8832 8832 9030 9030
4         3 9230 9230 9232 9232 9430 9430 9630 9630 9632 9632
4         4 9824 9824 9826 9826 9628 9628 982810230
4    UT   5 8028 8630 8032 8436 8634 8836 8438 8840
4         6 9032 9032 9432 9432 9034 9440 9634 9634 9636 9636 983210236
4         710816110261061810618104201062610222102221002410226
4         8 965010054
4         9 96461024810248102441025010250102521025210254102541025610256
4        10 9048 9450 8652 9456 9458 9458 9460 9460 965610060
4        1110444108441044811250104521105 6
6    PASN 1 8826 8832 9026 9036 9226 9228 9230 9448 9048 9048 9630 985210054
6         1102381025610442106561063010856110281104211238112381122411636
7         3 9026 9032 9232 9234 9434 9440 9636 9648 9838 98381003610038 99852
7         3100521065210048106481064210648108421104211038110401122611238111432
7         31162411628
7         2 8826 8832 9034 9034 9236 9240 9442 9448 9650 9652100541065410065
7    ROAD 2108441085211434114361163011632114241142611224112241102811036100
7         21044210448 984610246 9840 984410040100401023810238 9836 9836 99634
7         2 9432 9432 9226 9230
7         1 9242 92481025610656108541085610240102441004210044108301083611636
7         1 9430 9430 9632 9632 9834 9834
  5                                     Block
        NEWFET                          #2
        NEWROAD
        WATER           #3a
   25CRILENG
     CRAYWID CITY    3rd
 .111                #4
 1161211618 C F I
 1121411422 C F I    #5
 1081611022 C F I
 1061810618 C F I
 1042010626 C F I
 1022210222 C F I
 1002410626 C F I
 1162011822 A E H
 1082411426 A E H
 1042810636 A E H
 1043811856 B E G
  8826  8826 A E H
  9026  9026 A E H
  9226  9226 A E H
  9426  9426 A E H
  9626  9626 A E H
  9824  9824 A E H
  9826  9826 A E H
  8028  8236 C F H
  8432  8640 C F H
  8428  8630 A D G
  8828  9240 B E H
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            DECEMBER 1971                             ** RAYMID   **
 9428 9428  B E H
 9436 9436  B E H
 9438 9438  B E H
 9440 9440  B E H
 9430 9430  B F I
 9432 9432  B F I
 9434 9434  B F I
 962810236  A D G
 8042 9056  C F G
 7646 7856  C F G
 7250 7456  C F G
 963810248  C F H
 9242 9456  C F H
 945810060  C F H
 9656 9656  C F H
 9856 9856  C F H
1005610056  C F H
1025610256  C F H
 9650 9650  A E I
 9652 9652  A E I
 9654 9654  A E I
 985010254  B C G
 8826  A MP  1     90   90               136 68 34      7               2ST 1
 9026  B MP  1     90   90               136 68 34      7               2PT 1
 9426  H RB 17     95   95     100       200            5               1
 9626  H RB  9     95   95      52       200            3               1
 8828  A NL  4     90   90               136 68 34      4               6
 9028  C MF  1     90   90               136 68 34      7               2
 9228  B MF  3     90   90               136 68 34      3               7
 9428  E PG  3     70   70               136 68 34      4        135    2
 8830  F BS  4     90   90               136 68 34      3       1000    1
 9030  A FC  1     90   90               136 68 34      3               7TT 1
 9230  J RC 11     50   50        100400 157            9               5
 9430  K RC 12     50   50        200300 157            9               5
 9630  L RB 23     50   50         74176 157            9               1
 8632  I RB 17     80   80     100       190            6
 8832  I RH 22     75   75      86 64    187            6
 9232  F BG  4     90   90               136 68 34      5       1000    1
 9632  J RB 16     95   95     100       200            6               1
 9824  I RA 19     95   95      19       200            1
 9826  I RB 17     95   95      60 60    200            6
 8028  I RA  9     95   95       9       200            1
 8228  I RA 13     80   80         20    190            1
 8428  L RA 18     50   50            39 160            1
 8628  E BS  3     90   90               136 68 34      3       1000    1
 9628  I RB 18     50   50        100 88 157            6               1
 9828  J RB 19     60   60        100    170            6
10028  F RA 20     95   95      20       200            1
10228  H RA 21     95   95      20       200            1
 8030  I RA 22     95   95      20       200            1
```

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#6

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```
            DECEMBER 1971                                    ** RAYWID   **

  8230  I RA 18     80  80         28      185             1                  7
  8430  A TE  3     80  80                 136 68 34       6
  8630  K RB 13     60  60         80 50   175             9
  9830  K RB 12     50  50         68 50   157             9
 10030  G PS  5     90  90                 136 68 34       6          135
 10230  B FO  1     90  90                 136 68 34       3                  6
  8232  H RA 10     85  85      10         190             1
  8432  H RA 33     85  85      33         190             2
  9032  I RA 17     60  60         22      170             1
  9432  H RA 12     95  95      12         200             1
  9832  I RA 18     80  80         27      190             1
 10032  F PC  3    100  80                 136 68 34       4          125     2
 10232  H RA 15     60  60         12 12   170             1
  8234  L RA 10     85  85      10         190             1
  8434  L RA 25     85  85      24         180             1
  8634  H RB  9     80  80      50         173             3
  8834  J RB 20     75  75      70 70      167             7
  9034  G PC  4     70  70                 136 68 34       4          135     2
  9234  I RA 28     95  95      28         200             2
  9434  K RB 10     90  90      27 50      195             3
  9634  A TE  2     80  80                 136 68 34       4                  7
  9834  B FL  2     80  80                 136 68 34       4                  7
 10034  H RA 14     85  85      14         180             1
  8236  H RA  7     85  85       7         180             1
  8636  B SC  1     90  90                 136 68 34       1                  1
  8836  J RB 10     90  90      42 20      195             3
  9036  G PS  4     90  90                 136 68 34       6          135
  9636  J RB 11     80  80      56 18      185             3
  9836  H RA 38     60  60         35 35   170             2
 10036  A CR  1     80  80                 136 68 34       4                  4ST
  8638  L RA 17     95  95      17         200             1
  8838  L RA  9     95  95       9         200             1
  9038  L RA  9     95  95       9         200             1
  9238  L RA 10     85  85      10         180             1
  9438  L RA  6     40  40            13   150             1
  9650  I RA 44     95  95      50         200             2
  9850  G PS  3     90  90                 136 68 34       3          135
 10050  H RA 38     95  95      45         200             2
  9652  L RB 14     20  20           181   130             5                  1.
  9852  F BG  2     70  70                 136 68 34       3          1000    1
 10052  C CK  2     80  80                 136 68 34       8                  5ST  1
  9654  K RB 15     50  50         70 80   157             5                  1
  9854  J RB 20     75  75      46104      187             6                  1
 10054  E BS  2     80  80                 136 68 34       2          1000    1
  8244  H RA  4     80  80       4         185
  8444  L RA 11     20  20            23   130
  8844  J RA  5     60  60          6      170
  8448  I RA  8     50  50          6  6   157
  7852  H RA 10     85  85      10         180
  9052  J RA  6     80  80          8      180
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                DECEMBER 1971                                              ** RAYWID    **

   7854   L RA   5       40   40                  11 150
   8654   J RA   3       60   60               1   5 170                    1
   8854   J RA  23       90   90           13 13     195                    1
   9054   D FP   1       90   90                     136  68  34            7                 1
   8856   L RA   2       50   50                   4 160                    1
   9056   G PS   1       90   90                     136  68  34            1          125
   9640   K RA  18       60   60              23     170
  10040   K RA   6       20   20                  12 130
   9444   K RA   3       20   20                   7 130
   9644   J RA   4       60   60               6     170
  10244   K RA   7       70   70              10     180                    1
   9846   B EL   1       90   90                     136  68  34            2                 6
  10046   K RA  10       95   95           10        200                    1
  10246   J RA  10       85   85           10        180                    1
   9448   J RA   6       70   70               9     180                    1
   9648   F RA   8       95   95            8        200                    1
   9848   F PG   1       90   90                     136  68  34            1          135    2
  10048   D CR   2       90   90                     136  68  34            8                 4ST 2
  10248   K RA  10       70   70              14     180                    1
   9250   J RA   9       85   85            9        180                    1
   9450   D TE   1       80   80                     136  68  34            2                 7
  10250   I RB  14       80   80           48 48     185                    5
   9252   K RA  10       85   85           10        180                    1
   9452   G PG   1      100   80                     136  68  34            1          125    2
  10252   D FF   1       80   80                     136  68  34            1                 6
   9254   L RA  23       60   60              20  20 170                    1
   9454   L RA  12       60   60              10  10 170                    1
  10254   H RA  11       85   85           11        180                    1
   9256   K RA  30       85   85           26        180                    2
   9456   L RA  10       40   40                  20 155                    1
   9656   K RA  24       90   90           17 10     195                    1
   9856   G PG   1       70   70                     136  68  34            1          135    2
  10056   C CR   1       80   80                     136  68  34            4                 4
  10256   K RA  28       80   80           18 14     185                    2
   9458   K RA  12       95   95           12        200                    1
   9658   L RA   9       80   80              12     190                    1
   9858   L RA   5       50   50                  10 165                    1
  10058   K RA   9       85   85            9        180                    1
  11026   L RA   9       40   40                  19 150
  10630   K RA  22       80   80           10 16     185
  10632   J RA  10       60   60              10   6 170
  11232   I RA  13       85   85           13        180
  11234   C CR   1       90   90                     136  68  34                              3ST 1
  10636   K RA   6       50   50                  14 160
  11236   K RA   4       60   60               3   4 170
  11414   L RA   5       40   40                  10 145
  11614   J RA   7       70   70              10     180
  11814   H RA  10       85   85           10        180
  10816   I RA  30       95   95           30        200                    2
  11016   I RA  13       80   80              20     190                    1
```

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                 DECEMBER 1971                                          ** RAYMID   **

10618  H RA 20    80  80      30         190                2           
10818  E PS  1   100  70                 136  68  34        1        125
11018  I RA  9    80  80         12      190                1
11218  I RA  3    95  95       3         200
10420  C NL  1    90  90                 136  68  34        1                5
10620  K RA 12    50  50         10  10  157                1
10820  K RA  4    20  20              8  120                1
11020  D CR  1    90  90                 136  68  34        4                4.
10222  C FP  1    90  90                 136  68  34        7                1
10224  L RB  7    60  60         33  42  170                2
10424  L RA  5    40  40             10  150                1
10026  G PC  1    80  80                 136  68  34        1        135     2
10226  I RB  9    85  85      55         180                3
10640  L RA  4    20  20              8  145
11240  I RA  7    80  80       7         185
10842  I RA 12    75  75       6   8     187
11642  J RA  9    60  60         12      170
10644  K RA  6    40  40             12  150                1
10446  I RA 20    80  80      10  15     185                1
10646  E CR  1    80  80                 136  68  34        4                4FT 1
10848  I RA 17    80  80      10  11     195                1
10448  E PC  1    80  80                 136  68  34        1        135     2
10648  C FL  1    80  80                 136  68  34        2                6
11048  K RA 15    40  40             33  160                1
10652  J RA 14    75  75      10   6     187                1
10852  K RA  6    20  20             14  135                1
11452  K RA  7    50  50          3   9  157
 9236  P
 9426  C
 9240  P
 9440  P
 9242  P
 9442  P
 9244  C
 9844  R
10044  R
 9246  P
 9446  C
 9646  C
 9248  P
10452  R
10854  R
10444  R
10442  P
10642  C
10840  R
11040  R
10836  C
11036  C
10834  F
```

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10832	R
11032	Q
10830	R
11030	Q
11230	Q
11430	P
11028	P
11228	Q
11428	R
11628	R
8032	S
8436	S
8642	S
8644	S
7650	S
7850	S
8050	S
8250	S
11216	S
11416	S
11616	S
11816	S
11818	S
11646	S
11846	S
11052	S
11252	S
11054	S
11056	S
8438	T
8440	T
8652	T
8852	T
9460	T
10234	T
10236	T
11612	T
11812	T
10824	T
10826	T
10828	T
10628	T
10428	T
11648	T
11848	T
11650	T
11850	T
8450	U
8452	U
9860	U

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```
11214  U
10422  U
10624  U
10426  U
11828  U
10430  U
10440  U
11046  U
11246  U
11446  U
11652  U
11852  U
 7254  P
10856  S
10848  S
 8846  T
 9044  T
11842  P
10024  G
11034  T                          blank
                                  #7 blank
LT1          9426 3 18 9230 3 18 8632 1  6 9828 1  6 8430 2 12 9434 2 12
LT2   #8     9652 2 12 9454 1  6 9846 1  6
LT3         10224 1  610446 1  6      blank
SC1          9626 1  4 95 95  2  4 9230 3 12 70 70  9  9 9430 3 12 75 75
SC1          8632 1  4 90 90  3  4 9632 2  8 85 85  5  7 8232 2  8 95 95
SC1          8836 2  8 90 90  5  710034 2  8 85 85  6  6 9828 2  8 95 95
SC1   #9     9826 2  8 95 95  4  6
SC2          8654 1  4 80 80  3  310246 1  4 85 85  3  3 9254 1  4 90 90
SC2          9656 1  4 90 90  3  3 9850 3 12 90 90  8 10 9654 3 12 85 85
SC3         11016 1  4 90 90  3  310224 1  4 85 85  3  310630 1  4 80 80
SC3         10846 1  4 85 85  3  3        blank
TF1          8925 3 20 9329 1 12 8731 1 12 9933 3 20 8737 1 12
TF2   #10    9953 1 12 9157 1 12
TF3         10923 2 1610747 1 12      blank
FZ1          9426    20 9626    24 9030    20 9630    14 9632    12
FZ1          8428    4010230    30 8032    50 8232    40 8634    40 9434    30
FZ1          9438    30 9226   100
FZ2   #11    9850    28 9652    20 9852    2210054    12 8244    20
FZ2          9846    3010246    20 9252    20 9656    24 9658    21
FZ2          8654    30 8854    12
FZ3         10630    2011234    3011016    2010818    3010224    32
FZ3         10646     810846    1410652    2010852    40    blank
MS1          9026 1  4 90 90  3  3 9426 1  4 95 95  3  3 9428 3 12 90 90
MS1          9030 2  8 90 90  6  6 9630 2  8 50 50  9  9 9232 2  8 90 90
MS1          8428 2  8 40 40  9  9 9828 3 12 60 60  9  910230 1  4 90 90
MS1   #10    9032 2  8 60 60  6  6 8434 1  4 85 85  3  3 9434 1  4 90 90
MS1          9834 2  8 80 80  6  6 9038 1  4 95 95  3  3
MS2          9850 2  8 90 90  6  6 9852 1  4 50 50  6  6 9854 1  4 75 75
MS2          8854 1  4 90 90  3  3 9846 2  8 90 90  6  610252 1  4 80 80
MS2          9454 1  4 60 60  3  3 9858 1  4 80 80  3  3
```

```
           DECEMBER 1971                             ** RAYWID   **

FS3       11234 1  4 90 90  3  310818 1  4 70 70  3  310424 2  8 40 40
FS3       10446 2  8 80 80  6  6
```

blank

#13 b

```
11
13
15                                                                32  2 2
17                                                             33  3 33 3
19                                                       33  3    33
21                                                 22 33    33 23
23                                              33  2 33  3    2
25                               2              33 33  2  2  2 22  2  2 2
27                               2  2     33  3    3           2
29                    1  1  1 33  3  3  2 3     11  2  2  2  2 22  2  2 2
31                 3  3  3  3 33  3 33  3  3  3 32  2 2        21
33                    2  2  2 32 22 32  2  2  2 3       2  2 2  2
35                 3  3  3 3  3  2  3         1 3            2 23  3  3
37                         22 32    3           3              2        3
39                       2 22 33  3 32  2  2  2 23 32  2  2  2 22  2 2
41                         2  3     33  3 3     2   3 3        2      2 2
43                 2  2  2 22 32  2 32  2  3  3 23  3  3 23  3 23  3  3 3
45                         2  3     3           2         2 2  2
47           2  2  2  2 2  2  3     3           22  2  2  2  2 2
49                       2 22 33  3 32  2 2     31             32 2
51                 1 33  3 23       3     2     30  1  1 33  3 23  3 23 3
53                   3     2        3     33  3 23  3  3       2      2
55     2  2  3  3  3 33  3 23  3  3 32  3  3  3 33  2  2  2  2 22  2  2 2
57                                      1  1  1 3
59                                              3
```

blank

#15

```
 A              1500                  60        40        20
 B              1500                  60        40        20
 C              1500                  60        40        20
 D              1500                  60        40        20
 E              1500                  60        40        20
 F              1500                  60        40        20
 G              1500                  60        40        20
 H              1500                  60        40        20
 I              1500                  60        40        20
 J              1500                  60        40        20
 K              1500                  60        40        20
 L              1500                  60        40        20
 M              1500                  60        40        20
 N              1500                  60        40        20
 O              1500                  60        40        20
 P              1500                  60        40        20
 Q              1500                  60        40        20
 R              1500                  60        40        20
 S              1500                  60        40        20
 T              1500                  60        40        20
 U              1500                  60        40        20
 V            700000
 W            700000
```

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```
              DECEMBER 1971                                  ** RAYMID   **

    34    68    34    68    34    68
    68   136                68   136                       68   136
 1   50    55    1     2     3     4     5     6    20    15
 2   30    40    2     3     2     3     2     4
 3   15    20    4     1     1     2     1     3
FY  100000000                3000000              1000000
ET
MS  201000000               83800000             50300000
SC  174600000               95000000             40000000
FZ
EC
ER
 2   50    92    96    92    96    90    96    90    92
 1   25
 2   22
 3   15
      175          1500          700          500
12     1001001001001001001001001001001001001001001001001001001001001001001
14     100100100100100100100100100100100100100100100100100100100100100
16     100100100100100100100100100100100100100100100100100100100
18     100100100100100100100100100100100100100100100100100100
20     100100100100100100100100100100100100100100100100100
22     100100100100100100100100100100100100100100100100
24     100100100100100100100100100 8  80100100100
26     100100100100100100100100100
28     100100100100100
30     100100100100100
32     100100100100100
34     100100100100100
36     100100100100100
38     100100100100100100100
40     100100100100100100100
42     100100100100100
44     100100100100100
46     100100100
48     100100100
50     100
52     100
54     100
56     100
58     100100100100100100100100100100 88 88                  10010010010010010010100
60     100100100100100100100100100100100100                  10010010010010010010100
        9230       9030       9226       9232       9852       9850       10818  664
   9226      12      3      4     27     59    125
   8438      16      6      4     27     54    125
   8048      13      2      4     24     45    125
   9842      13      4      4     26     52    125
  11220      13      3      4     25     50    125
  11430      13      3      4     23     46    125
  11244      14      4      4     25     50    125
```

#19 blank

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```
              DECEMBER 1971                                 ** RAYWID   **

 8428    20                27  blank
 9230   100                27
11624    15    111162611626    30    111162811628    40    111163011630    45   1430
11430    55    111143211432    60    111143411434    75    111123411226    10   1228
11228    65   3111123011230    70    111123211232    75    111123411234   150   1236
11236   150    111123811238   162    111103811038   170    111104011040   170   1042
11042   170    111084210842   175    111064210642   175    111064410644   175  40646
10646   180    111064810648   180    111044810448   180    111024810248   180   0048
10048   185    11 9848 9848   255    11 964810652    20    111045210452    50  60252
10252    70    111005210052    70    11 9852 9852    70    11 9850 9850    70   9848
 9648   258    11 9646 9646   300    11 9644 9644   400    11 964211248   500 5
11448   510 59         9642   450    11 9640 9640   500    11 9440 9440   510   9438
 9438   530    11 943610036    42    111003810038    43    11 9838 9838    44   9638
 9638    45    11 9636 9636    50    11 9436 9436   590    11 9434 9434   581   9234
 9234   600    11 9232 9232   600    11 9032 9032   650    11 9030 9030   650   9028
 9028   650    11 9026 9026   650    11 8826 8826   800    11 8824 8824   800   9024
 9024   800    11 9224 9224   800    11 9424 9424   800    11 9624 9624   800   9622
 7012       5 7212      5 7412      5 7612      5 7812      5 8012      5 8212     5 8    5
 8612       5 8812      5 9012      5 9212      5 9412      5 9612      5 9812     510    5
10212       510412      510612      510812      511012      611212      611412     6 7    5
 7214       5 7414      5 7614      5 7814      5 8014      5 8214      5 8414     5 8    5
 8814       5 9014      5 9214      5 9414      5 9614      5 9814      510014     510    5
10414       510614      610814      611014      6 7016      5 7216      5 7416     5 7    5
 7816       5 8016      5 8216      5 8416      5 8616      5 8816      5 9016     5 9    5
 9416       5 9616      5 9816      510016      510216      510416      610616     6 7    5
 7218       5 7418      5 7618      5 7818      5 8018      5 8218      5 8418     5 8    5
 8818       5 9018      5 9218      5 9418      5 9618      5 9818      510018     510    6
10418       6 7020      5 7220      5 7420      5 7620      5 7820      5 8020     5 8    5
 8420       5 8620      5 8820      5 9020      5 9220      5 9420      5 9620     5 9    5
10020       610220      6 7022      5 7422      5 7622      5 7822      5 8022     5 8    5
 8422       5 8622      5 8822      5 9022      5 9222      5 9422      5 9622     6 9    6
10022       6 7024      6 7224      6 7424      6 7624      6 7824      6 8024     6 8    6
 8424       6 8624      6
 7226       6 7426      6 7624      6 7824      6 8024      6 8224      6 8424     6 8    6
 7626       6 7826      6 8026      6 8226      6 8426      6 8626      6 7222     5 8    5
 7818       5 7026      6                     blank
  1 N 1 0     12100
  2 M 2 2      4300
  3 M 4 3      1900
  4 N 5 0       300
  5 N 3 0      1000
  6 M 2 3      2000
  7 N 1 0      2300
  8 N 3 0      2300
  9 N 1 0      3300
 10 N 2 0      30
 11 M 3 2       700
 12 N 4 0      14
 13 M 5 2       10
 14 M 3 3       600
 15 M 1 3     1000
 16 M 4 3     10
 17 N 5 0      5            blank
  1   8034          60   8034      4
  1   8036          60   8034      4
  2   8640          60   9440      5
  2   8840          70   9440      5
  2   9040          70   9440      5
  3   8842          50   9642      5
  3   9042          50   9642      5
  4   8042          20   8442      4
  4   8242          20   8442      4
  4   8442          20   8442      4
  4   8044          20   8442      4
  4   7646          20   8442      4
  4   7846          20   8442      4
  4   8046          20   8442      4
  4   8246          20   8442      4    #42
  4   8446          20   8442      4
  4   8646          20   8442      4
  4   9046          20   8442      4
  4   7648          20   8442      4
  4   7848          20   8442      4
  4   8048          20   8442      4
  4   8248          20   8442      4
  4   8648          20   8442      4
  4   8848          20   8442      4
  4   9048          20   8442      4
  4   8650          20   8442      4
  4   8850          20   8442      4
  4   9050          20   8442      4
  5   7250          11   8252      4
  5   7450          11   8252      4
  5   7252          11   8252      4
  5   7452          11   8252      4
  5   7652          11   8252      4
  5   8052          11   8252      4
  5   8252          11   8252      4
  5   7454          11   8252      4
  5   7654          11   8252      4
  5   8054          11   8252      4
  5   8254          11   8252      4
  5   8454          11   8252      4
  5   7256          11   8252      4
  5   7456          11   8252      4
  5   7656          11   8252      4
  5   7856          11   8252      4
  5   8056          11   8252      4
  5   8256          11   8252      4
  5   8456          11   8252      4
```

```
               DECEMBER 1971                              ** RAYWID   **

 5   8656             11   8252      4
 6   9638             28   9640      5
 6   9838             28   9640      5
 6  10038             28   9640      5
 6  10238             28   9640      5
 6   9840             28   9640      5
 6  10240             28   9640      5
 6   9642             28   9640      5
 6   9842             28   9640      5
 6  10042             28   9640      5
 6  10242             28   9640      5
 7   9660             40   9660      4
 8  10060             45  10060      4
 9  10626             40  10626      4
10  11418             30  11418      4
10  11618             30  11418      4
10  11220             30  11418      4
10  11420             30  11418      4
10  10622             30  11418      4
10  10822             30  11418      4
10  11022             30  11418      4
10  11222             30  11418      4
10  11422             30  11418      4
11  11620             10  11626      2
11  11820             10  11626      2
11  11622             10  11626      2
11  11822             10  11626      2
11  11024             10  11626      2
11  11224             10  11626      2
11  11424             10  11626      2
11  11624             10  11626      2
11  11824             10  11626      2
11  11226             10  11626      2
11  11426             10  11626      2
11  11626             10  11626      2
11  11826             10  11626      2
12  10432             20  10634      4
12  10434             20  10634      4
12  10634             20  10634      4
12  10436             20  10634      4
13  11630             10  11434      5
13  11830             10  11434      5
13  11432             10  11434      5
13  11632             10  11434      5
13  11832             10  11434      5
13  11434             10  11434      5
13  11634             10  11434      5
13  11834             10  11434      5
13  11436             10  11434      5
13  11636             10  11434      5
```

```
   13 11836          10 11434     5
   14 10438          10 11042     5
   14 10638          10 11042     5
   14 10838          10 11042     5
   14 11038          10 11042     5
   14 11238          10 11042     5
   14 11438          10 11042     5
   14 11638          10 11042     5
   14 11838          10 11042     5
   14 11440          10 11042     5
   14 11640          10 11042     5
   14 11840          10 11042     5
   14 11042          10 11042     5
   14 11242          10 11042     5
   14 11442          10 11042     5
   14 10844          10 11042     5
   14 11044          10 11042     5
   14 11244          10 11042     5
   14 11444          10 11042     5
   14 11644          10 11042     5
   14 11844          10 11042     5
   15 11248          15 10646     5
   15 11448          15 10646     5
   15 10450          15 10646     5
   15 10650          15 10646     5
   15 10850          15 10646     5
   15 11050          15 10646     5
   15 11250          15 10646     5
   15 11450          15 10646     5
   16 10454          20 10452     5
   16 10654          20 10452     5
   16 10456          20 10452     5
   16 10656          20 10452     5
   17 11254          15 11254     4
   17 11454          15 11254     4
   17 11654          15 11254     4
   17 11854          15 11254     4
   17 11256          15 11254     4
   17 11456          15 11254     4
   17 11656          15 11254     4
   17 11856          15 11254     4
    1 7     12    20     4     8     16    32
    2 8     16    25     5     10    25    50
    3 5      9    15     3     6      9    18
    4 3      7    12     2     4      8    16
    5 2      5     9     1     2      3     6
    9426 TT6  9426 ST41 9030 TT3  9030 TT51 9632 TT5  9632 ST51 9824 TT4  9ST31
    8228 TT6  8228 ST21 9438 TT6  9438 TT4110420 TT4 10420 ST31 9852 TT4  9TT51
    9846 TT4  9846 ST51 9454 TT4  9454 ST4110646 TT3 10646 ST41
    9026 9426    1      9030 8632    1       9232 9230    1      9424 9828
```

```
                                                            ** RAYHID   **
            DECEMBER 1971
                                                   92241 0224    1      9852 9652
8824 8430     1      9436 9434     1             1064810446    1
9646 9846     1      9648 9454     1               9234 9230          9624 9828
9424 9426            9032 8632                   1021810224          10052 9652
7012 8430            9438 9434                   1064610446 blank
9848 9846            9850 9454
                                  blank.
 1 AL  500 #F47
 2 AL  550
 3 AL  540          blank
 150  170  190   34   68  136#F48
 18 0 10 12  9 10 11 2 1 0     11230#F49      blank
 9640 1  2  300   60  210   42  180   36  150   30
 9642    3  200   40  140   28  120   24  100   20
11042    5  400   80  280   56  240   48  200   40  #F50
10648 1 64  100   20   70   14   60   12   50   10
10848   64   50   10   35    7   30    6   25    5
11048   46   50   10   35    7   30    6   25    5
10252    3  100   20   70   14   60   12   50   10
11232 1 10  100   20   70   14   60   12   50   10  blank
HIST
  40   51   62   67    2100220024002700 A
  60   49   55   60    1700190021002500 B
  50   45   61   70    1300170017001800 C
  55   60   65   60    2100230025002500 D
  55   65   79   72      300 350 360 390 E
  60   70   81   85      500 510 530 540 F
  70   72   75   73      610 650 640 680 G
  70   72   75   70      500 520 540 570 H
  72   70   70   75      900 950 9601010 I
  68   61   69   75      630 640 680 690 J
  6    60   69   65      550 570 590 600 K
  59   49   54   70      470 480 480 510 L
   0    0    0    0       10  11  12  15 M
   0    0    0    0       10  11  12  15 N
   0    0    0    0       10  11  12  15 O
   0    0    0    0       50  55  60  60 P
   0    0    0    0       40  45  45  50 Q
   0    0    0    0       50  55  55  60 R
   0    0    0    0       60  60  70  70 S
   0    0    0    0       50  60  70  80 T
   0    0    0    0       50  50  60  60 U
   0    0    0    0      600 650 670 690 V
   0    0    0    0      600 650 700 710 W                               #51
SOCI                                                                        AA
300310290027023021020022025026024 0230                                       AA
 2650 2700 2800 3000 5900 6400 6500 6800121001230013000131 00               BB
300310290027023021020022025026024 0230                                       BB
 2650 2700 2800 3000 5900 6400 6500 6800121001230013000131 00               CC
300310290027023021020022025026024 0230                                       CC
 2650 2700 2800 3000 5900 6400 6500 680012100123001300013100
```

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```
        DECEMBER 1971                                   ** RAYWID   **

300310290270230210200220250260240230                                     DD
 2650 2700 2800 3000 5900 6400 6500 680012100123001300013100             DD
300310290270230210200220250260240230                                     EE
 2650 2700 2800 3000 5900 6400 6500 680012100123001300013100             EE
300310290270230210200220250260240230                                     FF
 2650 2700 2800 3000 5900 6400 6500 680012100123001300013100             FF
300310290270230210200220250260240230                                     GG
 2650 2700 2800 3000 5900 6400 6500 680012100123001300013100             GG
300310290270230210200220250260240230                                     HH
 2650 2700 2800 3000 5900 6400 6500 680012100123001300013100             HH
300310290270230210200220250260240230                                     II
 2650 2700 2800 3000 5900 6400 6500 680012100123001300013100             II
```

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```
           DECEMBER 1971                                        ** TWOCITY **
#1
  1     SR {1 7012 9428 7030 9230 7032 9234 7036 9060
  1        {2 961211828 943011830 943211834 923611860
  2        {1 7012 9428 7030 9230
  2     Sc {2 7032 9234 7036 9060
  2        {3 961211828
  2        {4 943011830 943211834 923611860
  3        {1 7012 9428 7030 9230 7032 9234 7036 9060
  3     MS {2 943011830 943211834 923611860
  3        {3 961211828
  4     UT {1 7012 9428 7030 9230 7032 9234 7036 9060
  4        {2 961211828 943011880 943211834 923611860
  6          1 701211860
  7        {1 9212 9228 7028 9028 70361003610034118341001210026
  7        { 11022611826
  7        {2 7030 9430 9412 9428 9812 98281002811828 7034 9834
  7        {2 983211832
  7        {3 7032 9632 9612 9630 983011830
  7                        ← blank
     WATER
   25CRELENG #3a
    41PAXLUS
             TWOCITY #3b
 J1
  8834 8860 2 5 7
  7012 9222 1 2 3
  7024 9224 4 3 6
  7026 9226 4 3 6     #5
  8828 9430 7 1 4
  9412 9420 1 2 3
  9422 9426 4 3 6
  7028 8660 2 5 7
  9238 9860 2 5 7
  9036 9060 2 5 7
  8832 9432 5 1 3
  9034 9434 5 1 3
  9236 9436 3 1 5
  961211820 5 4 1
  962210230 6 7 4
 1042211830 5 4 1
  963211836 7 6 2
 1003811860 7 6 2
  9434 9434   6
  9236 9436   6
  9238 9838 3 5 7                 blank
  9420   3                   22                          2  1
  8622   1                   24                          2  1
  8822   2                   22          #6              2  1
  9022   3                   22                          2  1
  9222   4                   22                          2  1
  9422   2 1A   1 40  55  50 16       2                  2  1  1
```

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```
                 DECEMBER 1971                          ** TWOCITY **

  9622  4 1A  1 40  30  20  17          2               2  1  1
  9822  7 1A  2 40  55  40  17          3               2  1  1
 10022  6 1A  4 40  60  50  11          7               2  1  1
  8624  5                   24                          2  1
  8824  6                   22                          2  1
  9024  7                   22                          2  1
  9224
  9424  3 1A  1 40  35  35  11       1                  2  1  1
  9624  6 1B  2 40  35  30   2         28               2  1  1
  9824  3 1B  3 40  35  30  14         32               1  2  1
 10024  3 1B  1 40  35  35  18         18               2  1  1
 10224  7 1A  4 40  60  60  11          7               2  1  1
  8826  2 1A  3 41  85  80  14       4                  2  1  1
  9026  6 1A  3 41  75  75   8       4                  2  1  1
  9226  5 1A  3 41  65  60   1       6                  2  1  1
  9426  5 1A  2 40  35  30   2       5                  2  1  1
  9626  1 CR  1 20 100 100                  110 55 28      4              1PT 1
  9826  1
 10026  7 1B  2 40  25  20  11         30               1  1  1
 10226  4 1A  3 40  60  60  14          7               1  1  1
 10826  4                   20                          1  1
  8628  3 1A  3 41  85  85  14    3                     2  1  1
  8828  2 1A  4 41  90  85   9       6                  2  1  1
  9028  6 1A  1 41  65  60   4       2                  2  1  2
  9228  2 9   1 30  90  90  17                  100 50 25   1  2  2    100
  9428  1 MF  1 20 100 100                  110 55 28      1              1
  9628  1
  9828  7 1B  1 20 100 100                  110 55 28      2              1
 10028  5 1A  4 40  30  25   9          8               1  1  1
 10228  4 1A  2 40  50  45  17       5                  1  1  1
 10428  2                   25                          1  1
 10628  6                   22                          1  1
 10828  7                   22                          1  1
 11028  1                   22                          1  1
  8230  6                   21                          2  1
  8430  5 1A  6 40  90  90   3    8                     2  1  3
  8630  5 1A  6 41  90  90   1    8                     2  1  3
  8830  2 1C  1 40  75  75   4   11 18                  2  4  3
  9030  4 1C  2 40  85  80   2   22 41                  2  3  2              1
  9230  5 8   1 30  90  90  14                  100 50 25   1  2  2    100    1
  9430                                                                        2
  9630  7 PA  1 20 100 100                  110 55 28      3              1ST 1
  9830  3 C   1 30  90  90  15                  100 50 25   1  2  2   1000    1
 10030  4 1A  2 40  35  30  13          5               1  1  1
 10230  4 1A  2 40  55  50  13       4                  1  1  1
 10430  3                   21                          1  1
 10630  2                   21                          1  1
 10830  5                   18                          1  2
 11030  3                   18                          1  2
  8232  2                   21                          2  1
```

```
                                                                  ** TWOCITY  **
              DECEMBER 1971
                                                                  2  1  3
 8432   6  1A   6  40   55   90    3    6                         2  1  3
 8632   4  1A   6  40   90   90    0    6                         2  1  3
 8832   6  1A   2  40   80   75    0    1   1                     2  2  3
 9032   6  1B   3  40   85   80    8   15   8                     1  3  3
 9232   6  1C   1  40   85   80   12   13  17                        3
 9432   7  FO   1  20  100  100                 110  55  28          3
 9632   1  MP   1  20  100  100                 110  55  28          7
 9832   2  7    1  30   90   80   14            100  50  25      .1  2  1      1000
10032   4  1B   2  40   65   55   15       23                     1  1  1
10232   4  1A   3  40   50   45   12        3                     1  1  1
10432   7                         21                              1  1
10632   1                         21                              1  1
10832   4                         18                              1  2
11032   6                         18                              1  2
 8634   6  1A   4  40   75   75   13    3                         2  1  3
 8834   2  1A   3  40   80   80    0    4                         2  1  3
 9034   5  1B   1  40   80   70    4    4   3                     2  2  3
 9234   2  1B   3  40   80   70   10   12  10                     2  2  3
 9434   3  1C   1  40   80   70    6   13   9                     2  2  3
 9634
 9834   5  1C   1  40   80   70   16   22   7                     1  3  3
10834   2                         25                              1  1
11034   7                         25                              1  1
 8836   6  1A   5  40   85   80   10    5                         2  1  3
 9036   3  1A   2  40   85   80   13    2                         2  1  3
 9236   4  1B   1  40   85   80    4    3   5                     2  2  3
 9436   4  1B   2  40   85   80    1   12   5                     2  2  3
 9636   6  1B   2  40   85   80   12    7   9                     2  2  3
 9836   4  1B   2  40   85   80   17   14                         2  2  3
 9038   6  1A   1  40   85   80   22    1                         2  1  3
 9238   4  1A   1  41   85   80    7    1                         2  1  3
 9438   6  1A   3  41   85   80    0    3                         2  1  3
 9638   4  1A   4  41   85   80    0    4                         2  1  3
 9838   3  1A   3  41   85   80    4    3                         2  1  3
 9440   4                         22                              2  1
 9640   3                         22                              2  1
 9614
 9814
 9616
 9816
 9618
 9818
 7630
 7830
 8030
 7632
 7832
 8032
10234
10434
```

```
10634                              ---blank
 1 1  55 15 10 10 00
 1 2  40 30 10 10 00
 1 3  00 20 40 10 00
 2 1  50 40 00 05 00
 2 2  40 40 05 05 00
 2 3  30 20 20 10 00
 3 1  80 00 00 05 00
 3 2  60 15 00 10 00
 3 3  40 05 25 10 00   #7
 4 1  80 05 02 03 00
 4 2  50 40 05 05 00
 4 3  37 23 25 10 00
 5 1  60 30 00 05 00
 5 2  30 30 15 10 00
 5 3  25 00 25 10 00
 6 1  55 20 10 10 00
 6 2  35 35 15 10 00
 6 3  42 08 40 10 00
 7 1  85 00 00 10 00
 7 2  30 30 30 00 00
 7 3  25 10 35 10 00   ----blank
UT1            9424 1  5         #8
UT2            9430 2 1110826 0   5 ---blank
SC1            9030 1  4 95 90  4  5
SC1            9032 1  4 95 90  4  5 #9
SC2            9834 1  4 95 90  2  4
SC2           10026 1  4 90 85  3  1 ---blank
DM2            9531 2  4              ---blank
PZ1            9030     6 8832     9 9034    12 9234     6 9026     6 8834    10
PZ1    #11     9226    13 9426    12 9028    13 8830    12
PZ2            9434    13 9634    20 9624    12 9236    12 9436    12 9238    12
PZ2            9438    10 9638     8 9838.   12 ----blank
MS1            9232 2  6 95 90  6  6
MS2    #12     9826 1  3 90 85  3  3
MS2            9430 1  3 85 80  3  3
MS2           10628 0  3    ----blank
RD1            9513S  2  2 90 9517S  2  2 90 9521S  2  2 90 9525S  2  2 90
RD1            8723E  1  1 90 8923E  1  1 90 9123E  1  1 90 9323E  1  1 90
RD1           08727E  1  1 9008927E  1  1 9009127E  1  1 9009327E  1  1 90
RD1            9127S  2  2 90 9129S  2  2 90 6931E  2  3 90 7131E  3  3 90
RD1  #13a      7331E  3  3 90 7531E  3  3 90 7731E  3  3 90 7931E  3  3 90
RD1            8131E  3  3 90 8331E  3  3 90 8531E  3  3 90 8731E  3  3 90
RD1            8931E  3  3 90 9131E  3  3 90                8733E  2  2 90
RD1            8933S  2  2 90 8935E  2  2 90 9135S  2  2 90 8727S  1  1 90
RD1            8729S  1  1 90 8731S  2  2 90
RD2            9511S  2  2 90 9515S  2  2 90 9519S  2  2 90 9523S  2  2 90
RD2            9527S  2  2 90 9137E  2  2 90 9337E  2  2 90 9529S  2  2 90
RD2            9531S  2  2 90 9533S  2  2 90 9535S  2  2 90 9537S  2  2 90
RD2            9539S  2  2 90 9541S  2  2 90 9543S  2  2 90 9545S  2  2 90
```

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```
            DECEMBER 1971                                      ** TWOCITY **

RD2          9547S  2  2 90  9549S  2  2 90  9551S  2  2 90  9553S  2  2 90
RD2          9555S  2  2 90  9557S  2  2 90  9559S  2  2 90  9537E  1  1 90
RD2          9523E  1  1 90  9723E  1  1 90  9923E  1  1 9010123S  1  1 90
RD2         10125S  1  1 9010127S  1  1 9010129S  1  1 9010927S  1  1 90
RD2         10929S  1  1 9010931S  1  1 90  9527E  2  2 90  9727E  1  1 90
RD2          9927E  1  1 90  9331E  3  3 90  9531E  3  3 90  9731E  3  3 90
RD2          9931E  3  3 9010131E  3  3 9010331E  3  3 9010531E  3  3 90
RD2         10731E  3  3 9010931E  3  3 9011131E  3  3 9011331E  3  3 90
RD2         11531E  3  3 9011731E  3  3 90  9731S  1  1 90  9733S  1  1 90
RD2          9735S  1  1 90 ←blank
FY1          8622      1 8822      1 9022      1 9222      1 9422      1 8624     1 8
FY1  #14     9024      1 9224      1 9424      1
FY2         10828     111030     110830     110832     111032      1
  1       A       93000         2 —blank 20         15         10 180000000
   0 24 351        7500
   7  2 620         300
  2       B      111000         2        10         08         06 210000000
   0 24 351        7500
   6  1 590        1000
  3       C       98000  #15    2        56         44         38 120000000
   0 24 351        7500
   5  9 651        1000
  4       D       89000         1        54         41         37 170000000
   0 24 351        7500
  5       E       92000         2        52         49         36 100000000
   0 24 351        7500
   1  2 680         500
  6       F       98000         2        59         46         35 190000000
   0 24 351        7500
   1  1 700         189
  7       G       90000         2        57         43         34 200000000
   0 24 351        7500
   2  8 631         895 —blank
     26    51    25    52  #16
     51   100   100   150    52   101   150   100 #17
 FY150131    500 SC147141   1200 MS145111    700 UT141091   1500 #19
 FY249071    650 SC249191   1900 MS248031    450 LT243151   1800
#20 1   40    40    30    00    10    00    15    15    20   300 —blank
    2   35    45    35    10    10    10    20    10    15   300 —blank
#21           50             55                   45          50
 FY     500000            0     1000000    3000000
 LT
 MS   100000000               12000000
#22 SC   12000000               10000000
 PZ                2000000                3000000
 BL
 RR
   9422   145 9622   135 9822   13010022   148 9424   145 9624   145 9824   13510 135
#23 10224   172 8826   176 9026   155 9226   150 9426   14510026   13510226   145 8 15
   8828   173 9028   16910028   14310228   155 8430   170 8630   183 8830   175 9 15
```

```
         DECEMBER 1971                                         ** TWCCITY  **

10030   14510230   150 8432   181 8632   180 8832   160 9032   166 9232   16710 154
10232   149 8634   168 8834   174 9034   150 9234   175 9434   180 9834   165 8 169
 9036   155 9236   153 9436   165 9636   146 9836   175 9038   150 9238   182 9 147
 9638   170 9838   168
#32 90    90    90     90     90     90     90     90     90   .   HYWAY MAINT LEVELS
 9422      72
 9622           31
 9822           33
 9424      78
 9624           18
 9824           14
10024           22
10224           25
10022           25
 8826      68
 9026      67
 9226      63
 9426  90  60
10026           21
10226           20
 8628  84
 8828      60
 9028      59
10028           31
10228      65
 8430  93
 8630  89
 8830  96  71
 9030  85  63
10030           29
10230      58
 8432  90
 8632  91
 8832  85  65
 9032  83  69
 9232  90  60
10032      69
10232      69
 8634  73
 8834  83
 9034  94  66
 9234  90  60
 9434  91  61
 9834  95  63
 8836  98
 9036  83
 9236  81  69
 9436  93  65
 9636  90  60
 9836  91
```

blank
#24 blank
#25 blank
#26 blank
#27 blank
#28 blank
#29 blank
#30 blank
#31 blank

#33

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DECEMBER 1971 ** TWOCITY **

```
   9038 92
   9238 93
   9438 94
   9638 95
  _9838 96 ---------blank
  1    15 #34
  2    16 ------blank
 B/CU        130         1300 #35      700          500  #36 blank
         9430        9430        9430        9430          9230       9230 #37
  9432       5      4      3     26     52     104 #38  ----blank
   9620   260     11 9622 9622   270    11 9624 9624   280    11 9626 9626   290   9628
   9612   100     11 9614 9614   150    11 9616 9616   200    11 9618 9618   250   9620
   9628   300     11 9630 9630   500    11 9632 9632   510    11 9432 9432   520   9232
   9232   530 #39 11 9032 9032   540    11 8832 8832   550    11 8632 8632   560   8432
   8432   570     11 8232 8232   580    11 8032 8032   590    11 7832 7832   600   7632
   7632   610     11 7432 7432   620    11 7232 7232   630    11 7032 7032   640
  11830    70     111163011630    80    111143011430    90    111123011230   100   1030
  11030   100     111083010830   100    111063010630   100    111043010430   120   0230
  10230   150     111003010030   170    11 9830 9830   200    11 9630
  9212     3 9412      3 #40 ------blank  <-- blank
  1 A 1 1     10   2 A 2 2     10    3 A 3 3      10 #41 ------blank
   1   7630   84      7   7632    15                 1   7830   84       8   7832    15
   1   8030   84     10   8032    15                 1   7632   84       7   7632    15
   1   7832   84      8   7832    15 #42             1   8032   84      10   8032    15
   2   9614   88      6   9614    20                 2   9814  100       5   9614    20
   2   9616   88      8   9616    20                 2   9816  100       6   9616    20
   2   9618   88     10   9618    20                 2   9818  100       7   9618    20
   3  10234  100     12  10430    25                 3  10434  100      11  10430    25
   3  10634  100     10  10430    25 ------blank
   1   7    12    20    40    80   160   320
   2   8    16    25    50   100   250   500 #43
   3   5     9    15    30    60    90   180 ------blank
   9426 CL30 9428 ST31 9830 CL20 9432 ST21 ---blank
   9622 9424    0      9620 9424    1      9830 9430     0        9432 9430
        E                                        ------blank
   1 AL  450
   2 AL  450 ------blank
     135   150   160    25    50   100
   14 8 10 12  9 10 11 2 1 0       9618 ------blank
   7432 1 84   400    50   300    40   200    30    50    20
   9620   88   200    90   150    50   100    40    25    15
 HIST
     52   49   45   44    1575159916201648                 A
     41   43   42   45     560  585  595  580            B
     25   39   51   47     725  727  735  750            C
     51   53   61   58     835  842  850  865           D
     57   59   65   61     568  581  577  587          E
     51   45   39   47     765  777  782  791            F
     71   68   65   59    1305129513251380                 G
 SOCIAL
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           DECEMBER 1971                                        ** TRCCITY  **
105120100105 95 80 90100 80 75 80 95
 2350 2400 2450 2500 5000 5000 5100 5000 9800 9900 995010000
105120100105 95 80 90100 80 75 80 95
 2350 2400 2450 2500 5000 5000 5100 5000 9800 9900 995010000
105120100105 95 80 90100 80 75 80 95
 2350 2400 2450 2500 5000 5000 5100 5000 9800 9900 995010000
105120100105 95 80 90100 80 75 80 95
 2350 2400 2450 2500 5000 5000 5100 5000 9800 9900 995010000
105120100105 95 80 90100 80 75 80 95
 2350 2400 2450 2500 5000 5000 5100 5000 9800 9900 995010000
105120100105 95 80 90100 80 75 80 95
 2350 2400 2450 2500 5000 5000 5100 5000 9800 9900 995010000
105120100105 95 80 90100 80 75 80 95
 2350 2400 2450 2500 5000 5000 5100 5000 9800 9900 995010000
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